THESIS

IMPROVED STICK NUMBER UPPER BOUNDS

Submitted by

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ABSTRACT

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A *stick knot* is a mathematical knot formed by a chain of straight line segments. For a knot K, define the *stick number* of K, denoted $stick(K)$, to be the minimum number of straight edges necessary to form a stick knot which is equivalent to K. Stick number is a knot invariant whose precise value is unknown for the large majority of knots, although theoretical and observed bounds exist.

There is a natural correspondence between stick knots and polygons in $\mathbb{R}^3$. Previous research has attempted to improve observed stick number upper bounds by computationally generating such polygons and identifying the knots that they form. This thesis presents a new variation on this method which generates equilateral polygons in tight confinement, thereby increasing the incidence of polygons forming complex knots. Our generation strategy is to sample from the space of confined polygons by leveraging the toric symplectic structure of this space. An efficient sampling algorithm based on this structure is described.

This method was used to discover the precise stick number of knots 9_{35}, 9_{39}, 9_{43}, 9_{45}, and 9_{48}. In addition, the best-known stick number upper bounds were improved for 60 other knots with crossing number ten and below.

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The foremost person I must thank for helping me complete this thesis is my advisor, Clay Shonkwiler. He is responsible for suggesting this interesting and fruitful topic for my master's thesis. Our many hours of discussion have always been insightful and enjoyable. Clay's guidance has been invaluable thus far in my graduate education.

I am indebted to Harrison Chapman for generously aiding me on several occasions. Without his help debugging code, there are many points where this research could have stalled. Thanks also for critiquing an early version of a talk, being a source of random polygon knowledge, and giving advice about academic life.

I'm also grateful to Jason Cantarella for giving me access to the `plCurve` project repository. Allowing me to branch the project made the results of this thesis possible.

I would be remiss if I didn't mention Colin Roberts and Brenden Balch who are always willing to talk about geometry with me. Plenty of the things I understand about symplectic geometry have come from grappling with these ideas at Colin's whiteboard. Additionally, they provided thoughtful feedback on the first draft of this thesis.

Finally, I am appreciative for the tremendous amount of love and support that my parents continue to share with me. A phone call with them is often the perfect antidote to a frustrating day.

DEDICATION

This thesis is dedicated to Juanita Duque Rosero.

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Chapter 1

Introduction

The stick number of a knot K is the least number of straight sticks which can be chained together to form K. This number is a knot invariant which has been studied since at least the 1990's [33]. Although the invariant can be easily and intuitively defined, relatively little is known about the precise stick number for most knot types. Prior to this thesis, stick number was known for only 31 of the 250 knots with crossing number ten or fewer, as can be observed in Section A.1.

Nonetheless, various theoretical and observed bounds for stick number exist. Many of the stick numbers which are known precisely have come from lowering the observed upper bounds until they became equivalent to the theoretical lower bounds. The most successful reductions in observed upper bounds have typically come from computational means, as in [34].

This thesis presents a new computational method for further reducing observed stick number upper bounds. Our strategy starts by considering stick knots as polygons in three-dimensional space. We try to randomly generate many such n-gons hoping that we will observe a sample forming a knot whose best-known stick number upper bound is greater than n. If so, this sample represents an improvement to the upper bound. We do not naively sample polygons, however. We consider an enriched sample of polygons in spherical confinement. Intuitively, sampling from the space of confined polygons should increase the chance that the samples form more complex knots.

As we can observe in Appendix B, the formation of complex knots is still rare in confinement; trivial knots predominate. Even so, sampling in this way does increase our odds of observing complex knots. Indeed, this method proved very effective at improving stick number upper bounds. After sampling 40 billion stick knots from the space of confined polygons, we were able to improve the best-known bounds of 65 knots with crossing number ten and below. Moreover, these reductions in upper bounds contributed to the discovery of the precise stick number of five knots. A full summary of results is presented in Chapter 4.

Chapter 2 provides definitions, background, and previous results relevant to the text. The chapter starts with a self-contained introduction to knot theory, focusing on the stick number invariant and methods for identifying knots. A review of selected topics from symplectic geometry follows. This material is necessary to describe the algorithm used to sample confined polygon space.

Chapter 3 details the algorithm, originally proposed in [13], we used to generate confined random polygons. This algorithm is based on the toric symplectic structure of confined polygon space. The chapter begins by describing this structure and the special properties it confers. The remainder of the chapter is devoted to a description of the algorithm, including pseudo-code. The goal is for the reader to be able to understand and implement the algorithm based on this description.

The final chapter presents the new stick number results mentioned above. In the first section we discuss the exact methodology used to generate polygons and identify their knot type. The main results of the thesis follow. The text concludes with a discussion of remaining questions and open problems. Additional avenues of research are suggested.

Detailed appendices are also included with the text. Appendix A contains tables listing the best-known upper bounds on stick number. All knots with crossing number ten and below are included, as well as bounds for selected knots with more crossings. Appendix B lists the frequency counts of sampled n-gons. Appendix C contains vertex coordinates for each knot type for which an improved bound was discovered. Finally, an index of important terms is available in Appendix D.

Chapter 2

Background

In order to understand the polygon generation algorithm described in Chapter 3 and give context to the results presented in Chapter 4, we first review some prerequisite concepts. This material falls roughly into two disciplines: knot theory and symplectic geometry.

Section 2.1 gives a self-contained introduction to the topics in knot theory which are referenced later in this thesis. Specifically, the section will cover: basic concepts and definitions; important classes of knots; knot invariants; and previous results related to stick number. Stick knots are the essential objects of study in this thesis and thus it is important for the reader to have a clear understanding of this material.

In contrast, the overview of relevant symplectic geometry concepts provided in Section 2.2 is briefer. This is due to the fact that these ideas are less central to the results of this thesis and because they require substantial background knowledge. Indeed, an understanding of the fundamentals of differential geometry is assumed. This section is included because it is necessary to understand the algorithm for randomly sampling confined polygons presented in Chapter 3. If the reader is only interested in the Chapter 4 results, then this section can safely be skipped.

2.1 Knot Theory

The titular subject of this thesis is the stick number invariant, a topic of study in knot theory. The purpose of this section is to explain this invariant and other ideas in knot theory which are relevant to the text. This introductory material is mostly self-contained. Many examples and figures are provided to promote the reader's understanding. If the reader requires further details on these topics, they can reference the excellent texts [1] and [35] or the citations within this section.

We begin with a definition of the eponymous objects of knot theory.

Definition 2.1.1. A *knot* $K : S^1 \to \mathbb{R}^3$ is a continuous embedding of the circle into three-dimensional Euclidean space.

We typically think of knots as the image of the map defined above. Recall that embeddings are injective, by definition, which implies that knots cannot have self-intersections. A given knot is often represented pictorially by a *knot diagram*, a projection of the knot onto a plane, recording information about the points where the projection crosses itself. Since these crossing points do not correspond to self-intersections, we know that one strand of the crossing must be going over the other (from the perspective of the projection) which we denote by white space around the crossing as in Figure 2.1.

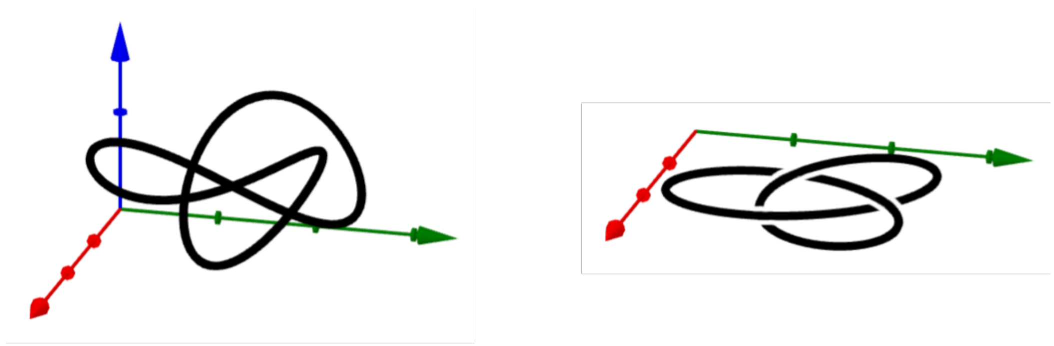


Figure 2.1: A knot in $\mathbb{R}^3$ with knot diagram corresponding to projection onto the xy-plane.

Consider stretching some segment of a given knot without tearing the knot or passing the segment through any other solid segment, as represented in Figure 2.2. After this deformation the knot will appear different, maybe even significantly so, but intuitively we haven't made the knot any more or less "knotted" than it was before. We can easily return the knot to its original state through an inverse deformation under the same constraints. These kinds of transformations may change the appearance of a knot but they do not change the inherent "knottedness". We would like to create a notion of equivalence between knots which makes precise this intuitive notion.

Figure 2.2: A sequence of knot diagrams representing a deformation.

As a consequence of their definition, (the image of) each knot is homeomorphic to the circle and thus to every other knot. Thus the usual topological notion of equivalence will not distinguish between different knots. We require the stronger notion of equivalence defined below.

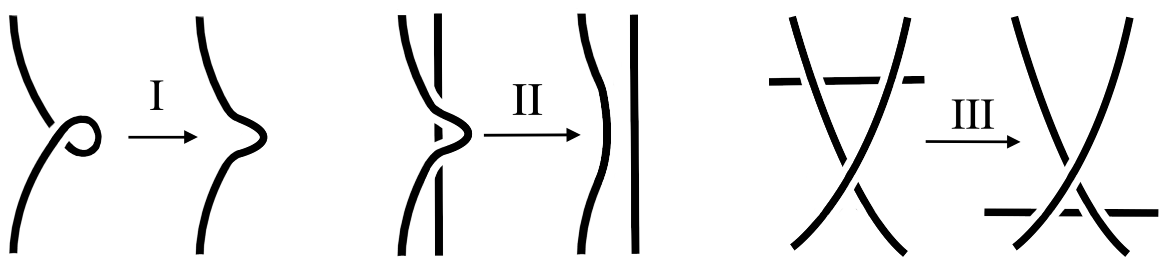
Definition 2.1.2. We consider two knots K and K' to be equivalent if there exists a continuous map $F : \mathbb{R}^3 \times [0, 1] \to \mathbb{R}^3$ such that:

- $F(\cdot, 0)$ is the identity map, and thus $F(K, 0) = K$;
- $F(\cdot, t)$ is a homeomorphism for each t;
- and $F(K, 1) = K'$.

Such a map is called an *ambient isotopy*.

Classifying knots up to ambient isotopy gives us an equivalence relation which matches our intuitive notion of what it means for two knots to be the same. The equivalence class that a particular knot belongs to is referred to as its *knot type*. This definition of equivalence does not, however, give us a practical way to compute whether two given knots have the same type. This leads to several natural questions: Given an arbitrary knot, can we always definitively find its knot type? Can we enumerate each type of knot? What is a feasible way to determine a knot's type? These questions are central to the study of knots.

One simple way to determine the type of a knot is to project down to a diagram and then deform the diagram (in ways that do not change the knot type) until the diagram appears identical to the diagram of a knot whose type is known. Stretching one strand of diagram in a way that neither introduces nor annihilates any crossings, as in the middle diagram of Figure 2.2, does not change the type of the corresponding knot. Likewise, it can be shown that each of the deformations in Figure 2.3 do not change knot type. These deformations are called *Reidemeister moves* and are specified as type I, II, or III.



(a) Type I **(b)** Type II **(c)** Type III

Figure 2.3: Performing any of the above deformations does not change the knot type of a diagram.

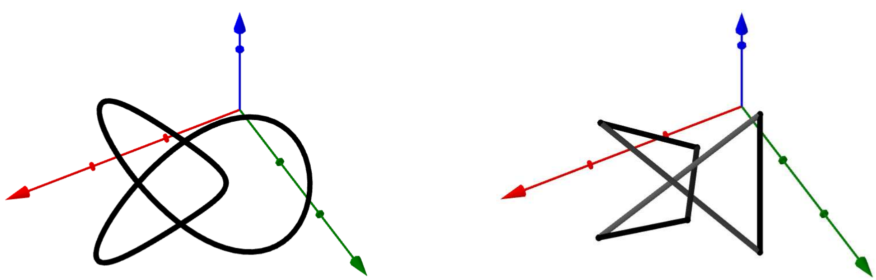
We can think of a type I Reidemeister move as untwisting a simple loop in a single strand. A type II move withdraws one strand which is lying over (or under) another. If one strand of a diagram is lying behind (or above) two other strands which meet at a crossing, then a type III move allows us to slide that strand to the other "side" of the crossing. It turns out that one can deform a given knot diagram to any other diagram of the same type using only these three moves [1]. This guarantees that the strategy for identifying knots by diagram deformation does work in principle, however, this method turns out to be prohibitively tedious in practice. Many good examples of manipulating knot diagrams using Reidemeister moves exist in the reference cited above, therefore we do not include one here.

Types of Knots

Consider a knot which is formed by a chain of straight line segments. Note that this is a valid knot by Definition 2.1.1; there is no inherent smoothness condition that knots must satisfy. This idea motivates the definition below.

Definition 2.1.3. A knot which is composed of a finite number of straight line segments is called a *stick knot*, sometimes referred to as a *polygonal knot*.

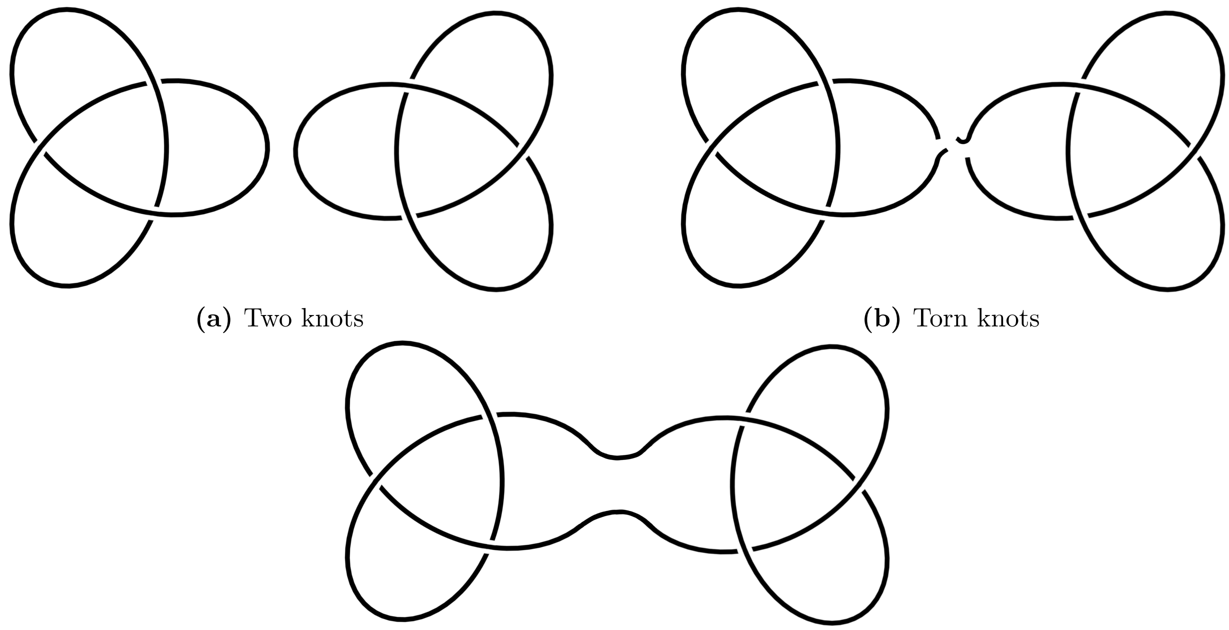
Figure 2.4 provides an example of two equivalent knots, one of which is a stick knot. This definition helps us to exclude certain pathological knots. We call a knot *tame* if it is equivalent to a stick knot; otherwise, we refer to the knot as *wild*. We will implicitly assume that all knots we consider are tame. Indeed, the main results of this thesis deal with stick knots directly.



(a) Knot **(b)** Stick knot

Figure 2.4: Two different knots of the same type.

Can we build complex knots by combining simple ones? Toward this end, define a composition operation on two knots which "tears" both knots at a point and connects the resulting ends so that the original knots are then joined as one knot. A pictorial example is given in Figure 2.5. This operation is the same as a topological connected sum. Rigorously defining knot composition requires putting an orientation on each knot, which is outside the scope of this text, however, one can find a detailed explanation in [1]. Composing two knots (up to choice of orientation) always yields a knot of the same type, regardless of precisely where the tearing and joining occurs.



(a) Two knots

(b) Torn knots

(c) Composed knots

Figure 2.5: Two knots can be composed by tearing and joining resulting ends.

If a knot is equivalent to the composition of two nontrivial knots we call it *composite*. Any knot which is not composite is referred to as *prime*. The composition of knots K_1 and K_2 is typically denoted $K_1 \# K_2$.

In knot theory it is often easier to consider a particular class of knots which share similar properties. We can then leverage these similarities to prove statements for the knots in the class that may be difficult to show for an arbitrary knot. *Torus knots* are one such class. A (p, q) torus knot is constructed by wrapping the strand of the knot around a standard torus, threading the strand p times through the torus hole while making q revolutions around the torus. The parameters p and q must be relatively prime if the strand is to connect back to itself to form a single knot. An example of a torus knot is depicted in Figure 2.6.

Torus knots are very symmetric as can be seen in the set of torus diagram examples in Figure 2.7. This fact along with the conveniently parameterized construction of these knots makes them an appealing class of knots for study. It can be shown that every torus knot is prime and that a (p, q) torus knot is equivalent to a (q, p) torus knot [1].

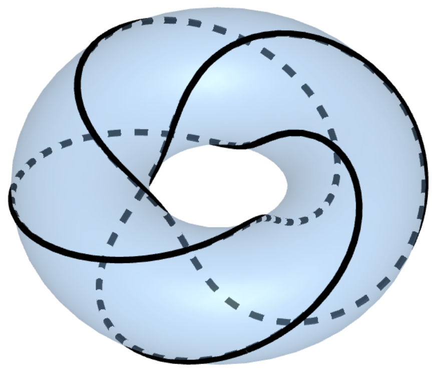
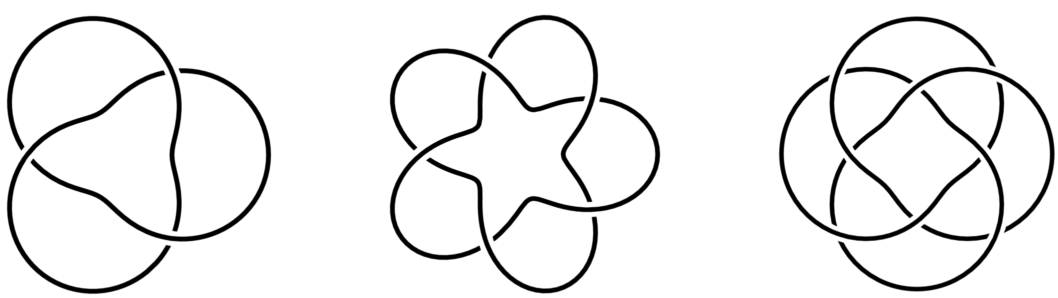


Figure 2.6: A $(4, 3)$ torus knot imposed on a torus.

We now consider another useful class of knots. Imagine being given a diagram representing a knot. Pick any point on the diagram and a direction to move along the strand. Think of moving along the strand in the chosen direction until you reach a crossing. Passing through this crossing we are either traveling "over" or "under" the crossing strand, from the perspective of the diagram. If we travel a full cycle (i.e. until we end up back at the starting point) and our path alternates between going over and under each crossing, then we call the diagram *alternating*.



(a) $(3, 2)$ torus knot **(b)** $(5, 2)$ torus knot **(c)** $(4, 3)$ torus knot

Figure 2.7: Three torus knot diagrams.

For example, the diagrams of Figure 2.7a and Figure 2.7b are alternating whereas the diagram of Figure 2.7c is not. The reader should convince themselves that each crossing will be passed exactly twice and that whether a diagram alternates is independent of the choice of starting point. Any knot which admits an alternating diagram is called an *alternating* *knot*, otherwise the knot is called *non-alternating*. Note that an alternating diagram may be equivalent to a diagram which is non-alternating, as is the case in Figure 2.2.

We will see that the results of Theorem 2.1.6 and Theorem 2.1.10 differ for alternating and non-alternating knots.

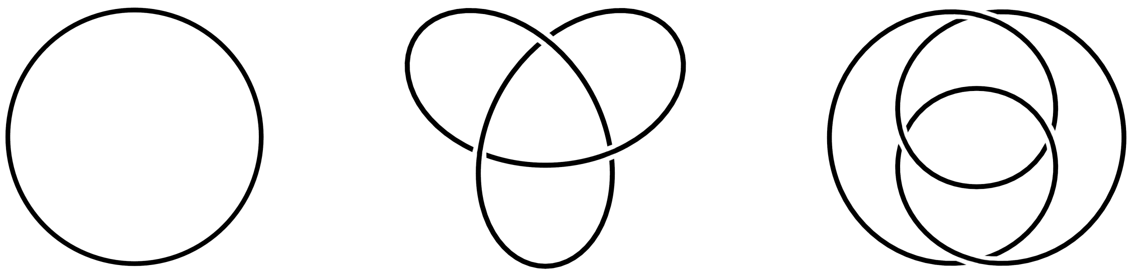
Knot Invariants

We can define computations on knots which associate some quantity to each knot. Of particular interest are mappings which take all knots of the same type to the same quantity. We call such relations *knot invariants*. These invariants are our primary tools in knot identification.

Knot invariants come in many different flavors: integer numbers, polynomials, groups, homology, etc. In this section we describe the subset of invariants relevant to this text. In particular, the invariants described will be referred to in Chapter 4 when discussing algorithmic identification of knots.

A central invariant in the study of knots is called the *crossing number* of a knot. The crossing number is defined to be the minimal number of crossings in any equivalent diagram of a knot. For example, the leftmost and rightmost diagrams in Figure 2.2 are equivalent because there is an ambient isotopy which transforms the corresponding knot of one into the corresponding knot of the other. The rightmost diagram has five crossings whereas the leftmost diagram has only three. This implies that the crossing number of this knot is less than or equal to three. In fact, this knot is commonly known as a *trefoil knot* and it is well-known [1] that it has a crossing number equal to three. That is, any diagram depicting an equivalent knot must have at least three crossings.

Figure 2.8 depicts diagrams of the three simplest knots. Figure 2.8a is called the *trivial knot* or the *unknot*. Since we can construct a diagram of the trivial knot which has no crossings, it necessarily has crossing number zero. As previously mentioned, the trefoil knot, shown in Figure 2.8b, has crossing number three. Figure 2.8c is colloquially known as the *figure-eight knot* and has crossing number four [1].



(a) Trivial knot or 0_1 **(b)** Trefoil knot or 3_1 **(c)** Figure-8 knot or 4_1

Figure 2.8: Knot diagrams of three simple knots.

Crossing number is commonly used to denote knot types. In this text we use *Alexander-Briggs notation* for knots with ten crossings or fewer. In this system, knots are denoted by their crossing number along with a subscripted index specifying the particular knot. For example, the trefoil is the only knot with crossing number three and is thus denoted 3_1. On the other hand, there are two knots with crossing number five which we denote by 5_1 and 5_2. The knots in Figure 2.8 are labeled with Alexander-Briggs notation in addition to their colloquial names.

For knots with crossing number greater than ten, we follow the convention suggested by J. Hoste, M. Thistlethwaite, and J. Weeks [18] and favored by "The Knot Atlas" [7]. Under this system knots are denoted by concatenating the character "K", the knot's crossing number, the character "a" if alternating or "n" if non-alternating, plus an integer index. For example, K11a66 denotes the 66th alternating knot with crossing number 11 and K12n385 denotes the 385th non-alternating knot with crossing number 12.

The real power of knot invariants is not notation but in differentiating between knots. It is important to emphasize, however, that knot invariants (in general) do not perfectly distinguish between different knot types. That is, there typically exist knots of different types which have the same image under a given invariant. For example, we mentioned above that there are two different knot types which have crossing number five. In fact, for any integer five or greater, there are multiple knots which possess this crossing number. If a knot invariant is known to differentiate between every knot type we call it a *complete invariant*. Complete invariants are known to exist in theory [16], however, there is very often a tradeoff between the computability of an invariant and its diagnostic power. Therefore, in practice, we typically rely on computing multiple different incomplete invariants and considering the intersection of the sets of candidate knots they identify.

For example, imagine that we are given a knot diagram of an unknown knot. We first note that the diagram has five crossings. Only five knots exist which have crossing number five or less, namely: 0_1, 3_1, 4_1, 5_1, and 5_2. Therefore, based on this information alone, we can conclude our diagram must represent one of these knots. But which one? We could try to use Reidemeister moves to remove some of the crossings and thus narrow down our choices, but this might not be possible or it might be unclear how to do such a simplification. Instead, we should compute another invariant which will be able to distinguish between these five knots. The invariants we discuss next have this power.

We now consider a family of invariants called *knot polynomials* which associate to each knot a (Laurent) polynomial. These invariants have proved to be good, though not perfect, at distinguishing between different knots while being feasible to compute and thus form the backbone of many practical knot identification efforts. A full discussion of knot polynomials is beyond the scope of this text, however, an intuitive introduction to their construction can be found in [1].

All of the knot polynomials mentioned in this text can be defined in terms of a *skein relation*, a system of equations which relate the knot polynomials of similar knot diagrams. A skein relation provides a convenient means for computing a knot polynomial. We can think of computation using a skein relation as decomposing the diagram of the knot under consideration. We decompose the diagram recursively, in each step focusing on a particular crossing. We change the crossing either by switching which strand crosses over the other or by removing the crossing altogether by cutting both strands and gluing opposing strands together. Both of these cases are shown in Figure 2.9.

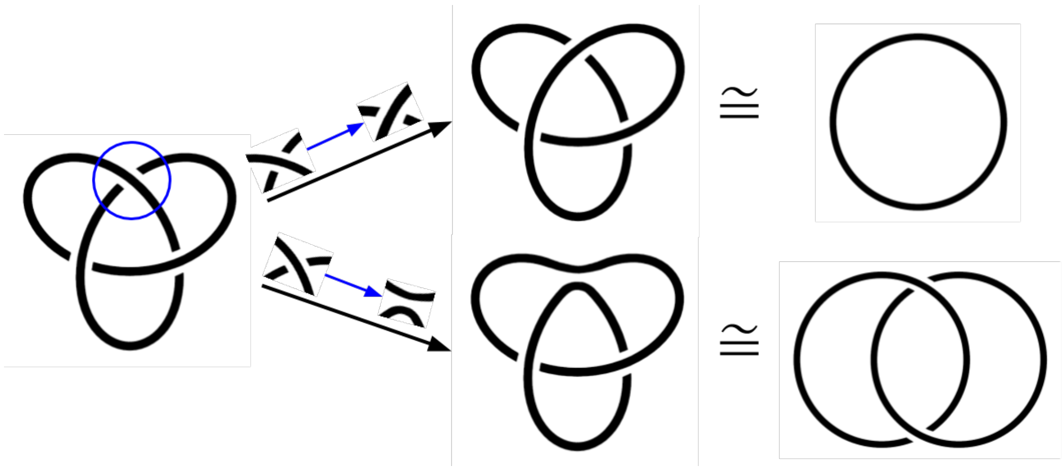


Figure 2.9: Decomposing the trefoil knot to calculate a knot polynomial.

Note that the result of changing a crossing in this way is certainly not ambient-isotopic to the original knot. Indeed, in the bottom case of Figure 2.9 we see that the result is not even a single knot, but two interlocked trivial knots. The polynomial associated to the original knot is equal to a combination, defined by the particular skein relation, of the polynomials of the resulting objects. We continue decomposing in this way until we are left with disjoint copies of the trivial knot, whose polynomial is defined to be 1. The result is an expression for our knot polynomial. Of course, this polynomial is the same for any equivalent knot diagram, as is necessary to be a knot invariant.

It's important to note that skein relations are not inherent to knot polynomials; there exist other ways to define and compute knot polynomials. The utility of a skein relation is the method of diagrammatic computation that it provides.

In practice, software libraries such as `plCurve` [5] calculate knot polynomials from sequences of integers representing a knot diagram. Specifically, `plCurve` represents knot diagrams as *planar diagram codes* [9, 26]. Similar representations used by other software programs are *Dowker codes* and *Gauss codes* [1]. The details of these codes are not relevant to this text; the interested reader can reference the cited materials for details. The important feature of these codes is that they represent knot diagrams as combinatorial objects.

We now move forward from our general discussion to mention the specific polynomials which we will use in this thesis.

The first knot polynomial was proposed by J. W. Alexander [3] and is called the *Alexander polynomial*. This invariant is a polynomial in one variable. Many years later, J. H. Conway described a skein relation for the Alexander polynomial and introduced a reparameterization which has come to be known as the *Conway polynomial* [1]. The second knot polynomial was discovered by V. Jones [22], again a polynomial of one variable and again named after its originator. Inspired by the discovery of the Jones polynomial, several different groups of researchers [15, 32] independently created a more powerful generalization in two variables called the *HOMFLY polynomial* or the *HOMFLY-PT polynomial*. These polynomials hold an important place in knot identification due to their feasibility of computation and power to distinguish between knot types.

One can show that the HOMFLY polynomial has strictly more diagnostic power than the Alexander or Jones polynomials [1] as these polynomials can be seen as special cases of the HOMFLY. Therefore, any time we use a polynomial for identification in this text, we are referring to the HOMFLY polynomial.

The HOMFLY polynomial is not a complete invariant, however. Many pairs of knots share the same HOMFLY, for example, the 5_1 and 10_{132} knots. We will need the invariant discussed next to distinguish between these knots.

Given a knot K, consider the ambient space around the knot which does not include the knot itself, that is, $\mathbb{R}^3 \setminus K$. The resulting space is a three-dimensional manifold called the *knot complement*. If we are able to assign a metric of constant curvature -1 to a knot complement then we call the corresponding knot *hyperbolic*. A large proportion of known knots are hyperbolic [1], however, exceptions exist. For example, torus knots are not hyperbolic [1].

The hyperbolic metric mentioned above can be used to compute the *hyperbolic volume* of the complement of a hyperbolic knot. It can be shown that this hyperbolic volume is a knot invariant [1]. In fact, hyperbolic volume has great diagnostic power, although it is not a complete invariant, even among hyperbolic knots.

The HOMFLY polynomial and hyperbolic volume invariants will be the two pillars of our knot identification efforts in Chapter 4.

Stick Number

We now arrive at a topic and an invariant which will be the primary consideration of this thesis. Recall that stick knots (Definition 2.1.3) are knots formed by a chain of straight line segments. Stick knots are of interest because chains of straight segments are often used as simple geometric models of biological and chemical objects [4, 25, 39].

Of particular importance in this text will be the subset of stick knots which have segments of equal length. Naturally, we call these *equilateral stick knots*.

A natural question to ask is, "given a particular knot type, what is the fewest number of edges necessary to construct a stick knot with the same type?" We formalize this notion in the definition below.

Definition 2.1.4. For a given knot K, define the *stick number*, denoted $stick(K)$, to be the minimal number of edges required to form a stick knot which is equivalent to K.

Stick number is also referred to as *polygon index* or *edge number*. We can define the analogous notion of an *equilateral stick number* by requiring equivalence to an equilateral stick knot. We denote equilateral stick number of a knot K by $eqstick(K)$. Note that since equilateral stick knots are a subset of all stick knots, it's clear that $stick(K) \leq eqstick(K)$ for all knots K. In this way, we can get upper bounds on stick number by considering the equilateral case. This is the approach we take in this thesis. The results stated in Chapter 4 come from generating equilateral stick knots, however, they serve as an upper bound to the more general case. Interestingly, no knot type has yet been proven to have differing stick number and equilateral stick number. Even so, being equilateral is a strict constraint and thus it is conjectured that these values are different for some knots [34].

As an example, consider the stick number of the trivial knot. A triangle is clearly ambient-isotopic to the trivial knot and it's also clear that a non-self-intersecting closed chain cannot be made from two (or fewer) straight segments. Therefore, the trivial knot has stick number three. The stick number for all other knots is much less obvious. In Figure 2.4 we have an instance of a six-edge stick knot which forms a trefoil. Is it possible to construct a trefoil with just five edges? It can be proved that the answer is no [33]. Six is the minimal number of edges required to form a trefoil stick knot. Consequently, the trefoil knot has stick number six. It is also known that the figure-eight knot (Figure 2.8) has stick number seven [33]. In each of these cases, the equilateral stick number is the same.

As a consequence of its definition, stick number is a knot invariant. However, this is a much different invariant than the others reviewed in this chapter. In particular, stick number is almost useless in distinguishing between knots. The reasons for this are twofold: first, because many different knots share stick numbers; second, because this invariant is practically impossible to compute given a representation of a knot of unknown type.

Then what is the significance of stick number? Much of the interest in this problem is motivated by curiosity about physically constructing such knots. That is, given n straight segments is it possible to construct the knot K? This curiosity extends to applications in science. Some laboratories have been working to synthesize molecules with interesting topologies, including knots [25]. It would be useful to know how they might construct these molecules in the most efficient way possible, that is, using the least number of molecular building blocks. (Of course, real applications are subject to physical constraints which may make the theoretical best-case impossible.) We can naively model a knotted molecule as a stick knot, where each edge represents an instance of the smallest molecular units. We see that stick number gives a lower bound for the number of these units necessary to construct a molecule which forms a particular knot.

Furthermore, knowing stick number does give us some diagnostic power when trying to identify stick knots. For example, if we were trying to identify a stick knot with seven edges, we would be able to rule out any knot types with stick number eight or greater.

We now turn our attention to known stick number results. The first exploration of stick number is due to R. Randell [33] who discovered the stick number of the trefoil and figure-eight knots. The first theoretical bounds on stick number in terms of crossing number were given by S. Negami [31]. The upper bound was later improved by Y. Huh and S. Oh; an improvement to the lower bound was given by J. Calvo. These bounds are summarized in the theorem below.

Theorem 2.1.5. *(Huh and Oh [19], Calvo [11]) The stick number of any nontrivial knot K can be bounded in terms of its crossing number, $c(K)$, by*

$$\frac{7+\sqrt{8c(K)+1}}{2} \;\leq\; stick(K) \;\leq\; \frac{3(c(K)+1)}{2}\ .$$

If we restrict to considering equilateral stick number, the best-known theoretical bounds become looser and are given by the following result.

Theorem 2.1.6. *(Kim, No, and Oh [24]) The equilateral stick number of any nontrivial knot K can be bounded above in terms of its crossing number, $c(K)$, by*

$$eqstick(K) \;\leq\; 2c(K)+2\ .$$

If K is non-alternating, then this bound can be improved to

$$eqstick(K) \;\leq\; 2c(K)-2\ .$$

The general stick number bounds presented above are loose for all knots other than the trefoil. If we want more precise information about stick number, it is productive to consider specific classes of knots. For example, Calvo thoroughly analyzed the space of eight-edge polygons to produce the following theorem.

Theorem 2.1.7. *(Calvo [10, 11]) The only nontrivial prime knots which can possibly be constructed with eight sticks are* 3_1, 4_1, 5_1, 5_2, 6_1, 6_2, 6_3, 8_{19}, *and* 8_{20}.

The above theorem is instrumental in proving one of the main results of this thesis, Theorem 4.2.1.

Analysis of torus knots has also yielded improved stick number results. The theorem below, discovered independently by two different groups of researchers, specifies the precise stick number for a subset of torus knots.

Theorem 2.1.8. *(Adams, Brennan, Greilsheimer, and Woo [2], Jin [21]) If* K *is a* (p, q) *torus knot where* $2 \leq p < q < 2p$ *then*

$$stick(K) \ = \ 2q \ .$$

Aside from studying these specific classes of knots, the best upper bounds on stick number have come from computational means. Both M. Meissen [28] and the team of E. Rawdon and R. Scharein [34] produced early upper bounds using the programs `KED` [20] and `KnotPlot` [36], respectively.

In particular, Rawdon and Scharein derived upper bounds on stick number and equilateral stick number for all prime knots with ten or less crossings. Their strategy was to start with a many-stick representative of each knot type. They then alternately agitated the knot and deleted a vertex, connecting the two loose vertices with a straight stick. They performed these operations in such a way as to preserve the knot type. This process would iterate until it was not possible to remove any further vertices without changing the knot type. The number of remaining edges became their stick number upper bound.

A table with the current best-known stick number bounds of knots with crossing number 10 or less is available in Appendix A.

In this thesis we also take a computational approach to further reduce the upper bounds on stick number. However, our generation scheme is entirely different from the process used by Rawdon and Scharein. We sample directly from the space of n-edge polygons in spherical confinement, as described in Chapter 3, then identify the knot formed by each sample, as described in Section 4.1. If we observe an n-gon which forms a particular knot K, then n is an upper bound on $stick(K)$. This method yielded improvements to the best-known stick number upper bounds of dozens of knots. These results are presented in Chapter 4.

All of the above stick number results relate to prime knots. There are also theoretical results known about composite knots. The same groups responsible for Theorem 2.1.8 also derived the following theorem.

Theorem 2.1.9. *(Adams, Brennan, Greilsheimer, and Woo [2], Jin [21]) The stick number of a composite knot $K_1 \# K_2$ can be bounded above in terms of the stick number of its components by*

$$stick(K_1 \# K_2) \ \leq \ stick(K_1) + stick(K_2) - 3 \ .$$

If we consider the equilateral stick number instead, we have

$$eqstick(K_1 \# K_2) \ \leq \ eqstick(K_1) + eqstick(K_2) \ .$$

Not only can we bound the stick number of composite knots by the stick number of their components, we can also bound by the crossing number of the component knots. This bound becomes much better if the components are non-alternating.

Theorem 2.1.10. *(Kim, No, and Oh [24]) The equilateral stick number of a composite knot $K_1 \# K_2$ can be bounded above in terms of its crossing number, $c(K)$, by*

$$eqstick(K_1 \# K_2) \ \leq \ 2c(K_1) + 2c(K_2) \ .$$

If one of the component knots is non-alternating this bounds improves to

$$eqstick(K_1\#K_2) \ \leq \ 2c(K_1) + 2c(K_2) - 4 \ .$$

Furthermore, if both knots are non-alternating then

$$eqstick(K_1\#K_2) \ \leq \ 2c(K_1) + 2c(K_2) - 8 \ .$$

We combine many of these stick number results with original results from Chapter 4 to produce a table of best-known stick number bounds in Appendix A.

2.2 Symplectic Geometry

The algorithm described in Chapter 3 is based on ideas from symplectic geometry which are reviewed here. This section is necessarily concise, as a full treatment of symplectic geometry requires a thorough understanding of differential geometry as presented, for example, in [37]. This section assumes knowledge of differential forms, diffeomorphisms, tangent spaces, and vector fields. Topics from symplectic geometry are covered only as needed for reference in Chapter 3, with several examples to impart some intuition about the material. For a fuller picture of symplectic geometry, the reader should reference [12] or [27].

For the entirety of this section we will assume that M is a manifold. We consider a specific class of manifolds which have additional structure given by the 2-form defined below.

Definition 2.2.1. A 2-form ω on M is called *symplectic* if

- ω is closed, that is, $d\omega = 0$;
- and ω is nondegenerate, which in this context means that at every point $p \in M$, if there exists a vector $\vec{u} \in T_pM$ such that $\omega(\vec{u}, \vec{v}) = 0$ for all vectors $\vec{v} \in T_pM$, then $\vec{u}$ is necessarily the zero vector.

A *symplectic manifold* is a pair (M, ω): a manifold M endowed with symplectic structure given by ω. As a consequence of the bilinearity, skew-symmetry, and nondegeneracy of ω, any symplectic manifold must have even dimension.

The prototypical example of a symplectic manifold is $(\mathbb{R}^{2n}, \omega_0)$ where $\mathbb{R}^{2n}$ has global coordinates $x_1, \ldots, x_n, y_1, \ldots, y_n$ and

$$\omega_0 \;=\; \sum_{i=1}^{n} dx_i \wedge dy_i \;.$$

In a theorem due to Darboux [12, §1.4] it was shown that at every point p in a $2n$-dimensional symplectic manifold (M, ω), there exists a coordinate chart $(U, x_1, \ldots, x_n, y_1, \ldots, y_n)$ centered at p such that

$$\omega \;=\; \sum_{i=1}^{n} dx_i \wedge dy_i$$

on U. This means that every symplectic manifold has the same local structure as $(\mathbb{R}^{2n}, \omega_0)$.

We would like to define a notion of equivalence between symplectic manifolds which preserves symplectic structure. The appropriate equivalence is defined below.

Definition 2.2.2. Let $\varphi : M_1 \to M_2$ be a diffeomorphism between symplectic manifolds (M_1, ω_1) and (M_2, ω_2). We call φ a *symplectomorphism* if $\varphi^* \omega_2 = \omega_1$.

Classifying symplectic manifolds up to symplectomorphism gives us an equivalence relation on the set of symplectic manifolds.

Recall that a *Lie group* is a manifold G equipped with a smooth group structure. By definition, the *action* of a Lie group G on a manifold M is a group homomorphism $\Psi : G \to \mathrm{Diff}(M)$. We call Ψ a *symplectic action* if the image of Ψ is contained in the subgroup of symplectomorphisms, Sympl(M, ω).

As an example, consider $(\mathbb{R}^2, \omega_0)$. Note that $\mathbb{R}$ is a Lie group under addition. We can imagine $\mathbb{R}$ acting on $\mathbb{R}^2$ by vertical translation. Any diffeomorphism which describes such a vertical translation preserves the symplectic form and is thus a symplectomorphism. Since every translation corresponds to a symplectomorphism, it follows that such an action is symplectic.

In fact, this smooth translation action gives rise to a complete vector field in the following way. Let Ψ_t denote the symplectomorphism which translates points in $\mathbb{R}^2$ downward by t.

We can generate a vector field X defined by

$$X(p) \;=\; \left.\frac{d\Psi_t(p)}{dt}\right|_{t=0} .$$

In this example, we see that $X = -\frac{\partial}{\partial y}$, where X is illustrated in Figure 2.10. We can generate a vector field from a smooth action of $\mathbb{R}$ or S^1 on a symplectic manifold M in the same way. We call this the *vector field generated by* Ψ, where Ψ is our smooth action. See [12, §21.3] for more detailed information. We require this concept for the following definition.

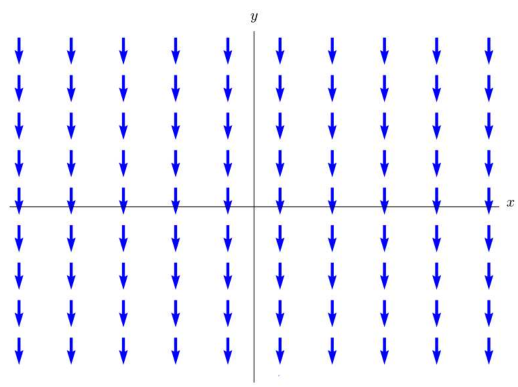


Figure 2.10: $\mathbb{R}^2$ vector field generated by vertical translation.

Definition 2.2.3. A *Hamiltonian action* is a symplectic action Ψ of $\mathbb{R}$ or S^1 on a symplectic manifold (M, ω) such that there exists a map $\mu : M \to \mathbb{R}$ satisfying $\omega(X, \cdot) = d\mu$, where X is the vector field generated by Ψ. We call such a map μ the *moment map*. We extend this definition by calling an action of the n-torus, T^n, Hamiltonian if the restriction of this action to each factor of S^1 is Hamiltonian. In this case we get a moment map $\mu : M \to \mathbb{R}^n$.

Hamiltonian actions and their associated moment maps are of importance because they describe actions with *conserved quantities*, given by the image of the moment map. For example, consider the sphere S^2 described in cylindrical coordinates θ and z. We can put a symplectic structure on this manifold by identifying it with its standard area form in cylindrical coordinates, $d\theta \wedge dz$. We can think of rotating the sphere around its z-axis as an action by S^1. In fact, this action is symplectic because the diffeomorphisms corresponding to such rotations preserve the symplectic form.

If we consider the orbit of points on the sphere under this action, we see that they form lines of latitude, parallel to the "equator" of the sphere. This action generates a vector field $X = \frac{\partial}{\partial\theta}$ as shown in Figure 2.11. Note that the contraction $d\theta \wedge dz(X, \cdot)$ evaluates to

$$d\theta \wedge dz\left(\frac{\partial}{\partial\theta}, \cdot\right) \;=\; d\theta\left(\frac{\partial}{\partial\theta}\right) \wedge dz \;-\; dz\left(\frac{\partial}{\partial\theta}\right) \wedge d\theta \;=\; dz\ .$$

Consider a map $\mu : S^2 \to \mathbb{R}$ defined by $\mu(\theta, z) = z$. We see that $d\mu = dz = d\theta \wedge dz(X, \cdot)$ from which it follows that this rotation action is Hamiltonian with associated moment map μ. The image of this moment map is z, which we interpret as meaning that this quantity is conserved under the rotation action. This makes intuitive sense because as points on the sphere rotate around the z-axis, their cylindrical height does not change.

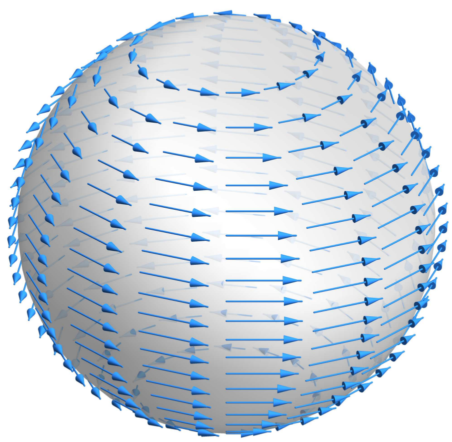


Figure 2.11: The vector field generated by rotation around the z-axis of the sphere.

In Chapter 3, we will be particularly concerned with Hamiltonian torus actions. The following terminology will be used to describe symplectic manifolds that admit such actions.

Definition 2.2.4. A $2n$-dimensional symplectic manifold (M, ω) is called a *toric symplectic manifold* if there exists a Hamiltonian torus action by T^n on M.

Note that the definition above specifies action by an n-torus where n is precisely half the dimension of M. Toric symplectic manifolds have special structure which we will exploit to great effect when generating random polygons. One such property is reflected in the following theorem.

Theorem 2.2.5. *(Atiyah [6], Guillemin and Sternberg [17]) Let M be a compact, connected symplectic manifold with moment map $\mu : M \to \mathbb{R}^k$. The image of μ is a convex polytope $P \subset \mathbb{R}^k$ whose vertices are the image of the fixed points of M under the corresponding Hamiltonian action.*

The algorithm described in Section 3.2 depends on this convexity property of symplectic manifolds. Before we can illustrate a second important property of toric symplectic manifolds we must first mention some probabilistic ideas as they relate to symplectic geometry.

Since the symplectic form ω is by definition nondegenerate, we can supply a natural volume form $dm = \frac{1}{n!}\omega^n$ on any symplectic manifold called the *symplectic volume*. This volume form induces a corresponding measure on the manifold called the *symplectic measure* or the *Liouville measure*. When sampling from a symplectic manifold, this is the probability measure which we consider. The following theorem gives us a practical way to perform such sampling on a toric symplectic manifold.

Theorem 2.2.6. *(Duistermaat and Heckman [14]) Let M be a $2n$-dimensional toric symplectic manifold with moment map $\mu : M \to \mathbb{R}^n$. Also let P be the image of μ, T^n be the n-torus, and $\alpha : P \times T^n \to M$ be a parameterization of a full-measure subset of M which is compatible with μ. If we consider the uniform measure on P, the standard measure on T^n, and the symplectic measure on M, then α restricted to $\mathrm{int}(P) \times T^n$ is measure-preserving.*

This theorem tells us that we can sample a toric symplectic manifold by instead sampling from the product of simpler spaces. Sampling a toric symplectic manifold is precisely what we wish to do in Chapter 3. In Section 3.1 we describe how to find an appropriate parameterization α for the toric symplectic manifold under consideration. Another description of this theorem with a corresponding example is given in [13].

Chapter 3

Generating Random Polygons in Confinement

To implement our strategy for improving the best-known upper bounds on stick number, as described in Chapter 1, we need an algorithm that is able to rapidly generate polygons in confinement. This chapter is devoted to describing such an algorithm.

Section 3.2 details the particular algorithm used to generate all polygons described in Chapter 4. Pseudo-code and a textual description of the algorithm are included so that the interested reader may create their own implementation. Otherwise, there is a reference to an existing implementation. Recommended values of algorithm parameters are also discussed.

Section 3.1 provides the prerequisite knowledge necessary to fully understand the algorithm from Section 3.2. This discussion depends on an understanding of topics in symplectic geometry which are reviewed in Section 2.2.

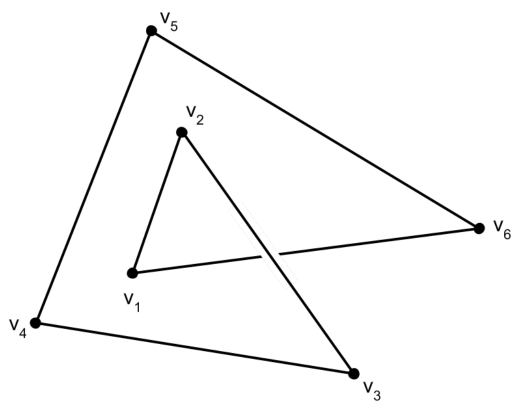
The algorithm described in this chapter was introduced by J. Cantarella and C. Shonkwiler in [13]. The content of this chapter summarizes the algorithm and surrounding information originally presented in their work. The reader should reference this paper any time additional details are desired.

3.1 The Space of Confined Equilateral Polygons

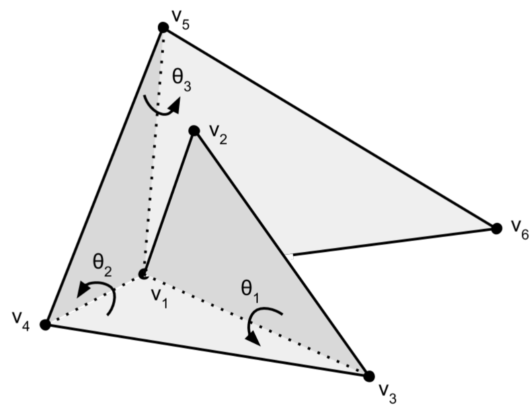
Consider an ordered collection of n unit-length, real-valued, three-dimensional vectors such that the sum of all the vectors is the zero vector. We can think of this vector set as defining a class of equilateral n-edge polygons in three-dimensional space, related by translation. The fact that the sum of all vectors is zero guarantees that the corresponding polygon is closed. Denote the space of such (unconfined) equilateral n-edge polygons as $\mathrm{Pol}_3(n)$. This space already equates polygons related by translation, we would further like to consider polygons to be equivalent if they are related by rotation. Toward this end, we quotient this space by three-dimensional rotations, SO(3), to get our desired polygon space denoted $\widehat{\text{Pol}}_3(n) = \text{Pol}_3(n)/\text{SO}(3)$. We first consider this unconfined space before moving on to the subspace of confined polygons.

To sample $\widehat{\text{Pol}}_3(n)$, we first must find coordinates on this space. We will use the coordinates resulting from the *fan triangulation* of the polygon, as these will prove to be convenient when we consider confined polygons. Fan triangulation is illustrated in Figure 3.1. The fan triangulation coordinates are derived by first fixing a root vertex of the polygon, then extending a chord (i.e. "fanning out") from this vertex to each of the $n-3$ nonadjacent vertices. This will divide the polygon into $n-2$ different triangles, each of which has a vertex at the root. Now consider the dihedral angle between each pair of adjacent triangles. Label each of these $n-3$ angles sequentially as $\theta_1, \ldots, \theta_{n-3}$. Each of these dihedral angles corresponds to one of the $n-3$ chords that we extended from our root vertex. Label the length of each chord as $d_1, \ldots, d_{n-3}$, corresponding to the appropriate dihedral angle. This set of $2n-6$ values defines coordinates on (an open dense subset of) $\widehat{\text{Pol}}_3(n)$ [13].

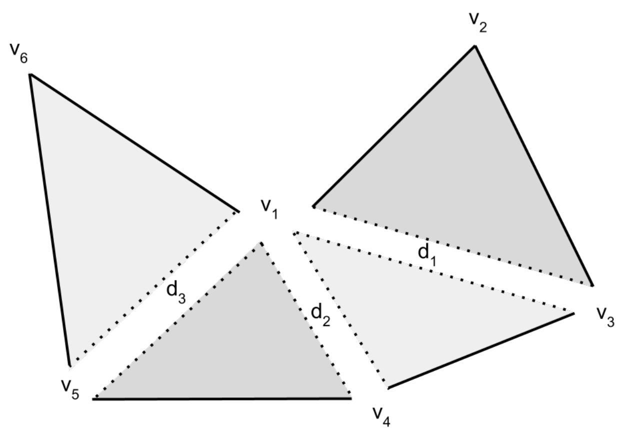
We pause to consider the parenthetical remark above. Fan triangulation fails when one of the d_i chord lengths is zero. In this case, we cannot determine the associated θ_i coordinate, nor any adjacent θ_{i-1} and θ_{i+1} values, because our triangulation would result in singular triangles and thus angles between such triangles would become ambiguous. For example, consider the picture in Figure 3.1c. If d_2 were to have zero length, then the two "middle" triangles would then have zero area and it would not be clear how we would calculate the angles between any two adjacent triangles as in Figure 3.1b. Of course, any polygon that has a chord length of zero would be self-intersecting and thus unsuitable for consideration as a stick knot, which is our desired interpretation of these polygons. This point, combined with the fact that the subspace of $\widehat{\text{Pol}}_3(n)$ that we can coordinatize by fan triangulation is a full-measure subset of the space [13], means that sampling using these coordinates is sufficient for our purposes.



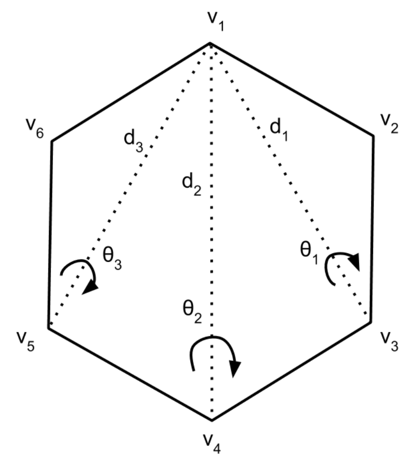
(a) Begin by choosing a root vertex, v_1



(b) Extend chords from root vertex to all non-adjacent vertices, measuring angles between resulting triangles



(c) Measure length of resulting chords



(d) We now have coordinates in terms of θ_i and d_i

Figure 3.1: Illustration of fan triangulation coordinates on $\widehat{\mathrm{Pol}}_3(6)$.

The reader should convince themselves that any polygon can be decomposed into fan triangulation coordinates and conversely that given a set of (nonsingular) coordinates $\theta_1, \ldots, \theta_{n-3}, d_1, \ldots, d_{n-3}$ one can unambiguously reconstruct an element of $\widehat{\mathrm{Pol}}_3(n)$, as illustrated in Figure 3.1.

Each θ_i coordinate can take any value in the range $[-\pi, \pi)$ and thus the space of valid θ coordinates can be thought of as an $(n-3)$-torus. However, the d_i chord lengths are more constrained. Specifically, we see that each chord forms a side of two triangles, as in Figure 3.1c. It follows that the d_i coordinates must obey a series of triangle inequalities.

Recalling that our polygon edges (the solid lines in Figure 3.1c) have length 1, we can summarize the appropriate triangle inequalities as

$$0 \leq d_1 \leq 2, \qquad 1 \leq d_i + d_{i+1}, \qquad -1 \leq d_i - d_{i+1} \leq 1, \qquad 0 \leq d_{n-3} \leq 2 \qquad (3.1)$$

for $1 \leq i \leq n-4$. The set of d_i chord lengths which satisfy these inequalities forms a polytope of the type pictured in Figure 3.2.

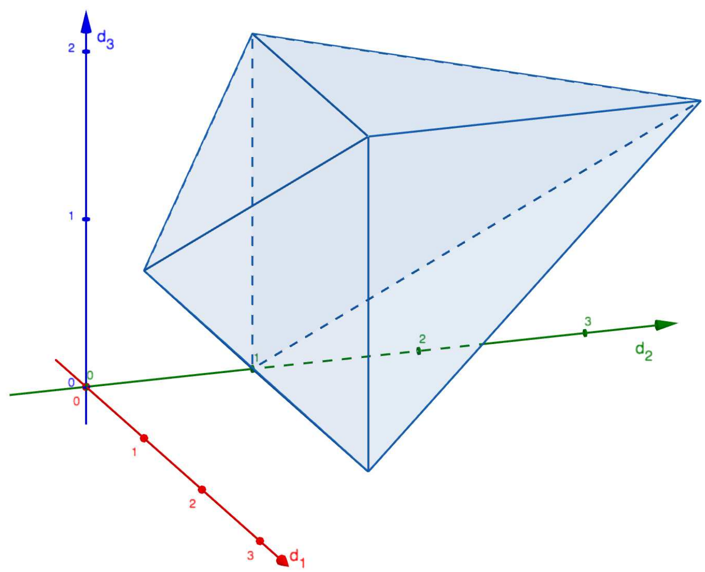


Figure 3.2: Polytope representing valid $\widehat{\mathrm{Pol}}_3(6)$ chord lengths.

There is a natural torus action on $\widehat{\mathrm{Pol}}_3(n)$ which one can visualize by imagining the effect of twiddling the θ values for a given polygon. By changing a particular θ_i, the polygon will appear to fold along the axis through the chord d_i; the result of changing multiple θ values is equivalent to the appropriate individual folds happening in sequence. Note that the chord lengths are preserved by this torus action.

In fact, $\widehat{\mathrm{Pol}}_3(n)$ is (with the possible exception of a singular, measure-zero subset) a toric symplectic manifold [13, §4, Theorem 13]. It follows that there is an associated moment map $\mu : \widehat{\mathrm{Pol}}_3(n) \to \mathbb{R}^{n-3}$ whose image is the conserved quantity, namely the d_i coordinates, since the natural torus action on $\widehat{\mathrm{Pol}}_3(n)$ preserves chord lengths. In fact, a theorem of M.

Kapovich and J. J. Millson [13, 23] proves that the image of the corresponding moment map is the same convex polytope generated by considering the triangle inequalities in (3.1). We call this shape the *moment polytope*.

Furthermore, Theorem 2.2.6 implies that we can sample $\widehat{\mathrm{Pol}}_3(n)$ using a pushforward of the product measure on $T^{n-3} \times \mathrm{int}(P)$ where P is the convex polytope formed by the image of μ. That is, sampling points from T^{n-3} and $\mathrm{int}(P)$ using the standard measure and Lebesgue measure, respectively, is equivalent to sampling polygons from $\widehat{\mathrm{Pol}}_3(n)$ using the symplectic measure. This is convenient because the torus and the polytope are both straightforward to sample in this manner.

Having described the space of unconfined polygons, we now turn our attention to the space of polygons in confinement. First, we must describe precisely what we mean by confinement. We will consider equilateral polygons *in rooted spherical confinement* of radius R around a root vertex. This means that we will fix some vertex of the polygon as our root and require that all other vertices be less than a distance of R away from the root. This requirement guarantees that the entire polygon will reside in a sphere of radius R centered at the root, as depicted in Figure 3.3. We will denote the space of equilateral n-edge polygons (related by translation and rotation) in rooted confinement of radius R as $\widehat{\mathrm{Pol}}_{3,R}(n)$. Note that this space is a subset of $\widehat{\mathrm{Pol}}_3(n)$ and that, if we let our confinement radius become large enough, the two spaces are equivalent. Specifically, if $R \geq \left\lfloor \frac{n}{2} \right\rfloor$, then $\widehat{\mathrm{Pol}}_{3,R}(n) = \widehat{\mathrm{Pol}}_3(n)$.

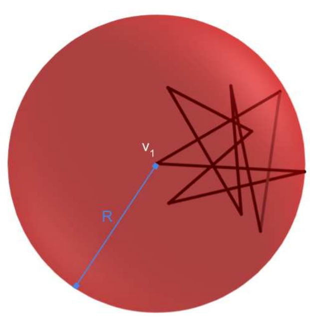


Figure 3.3: Polygon in rooted confinement of radius R around vertex v_1.

As a subspace, $\widehat{\text{Pol}}_{3,R}(n)$ inherits the same toric symplectic structure as $\widehat{\text{Pol}}_3(n)$. In fact, the moment polytope of $\widehat{\text{Pol}}_{3,R}(n)$ is a subpolytope of the corresponding one for $\widehat{\text{Pol}}_3(n)$ which can be generated by considering the same triangle inequalities of (3.1) plus the additional confinement inequalities

$$d_i \leq R \tag{3.2}$$

for $1 \leq i \leq n-3$. An example of a confined polytope is illustrated in Figure 3.4 and can be compared to the unconfined case of Figure 3.2. Confined polytopes are still guaranteed to be convex by Theorem 2.2.5.

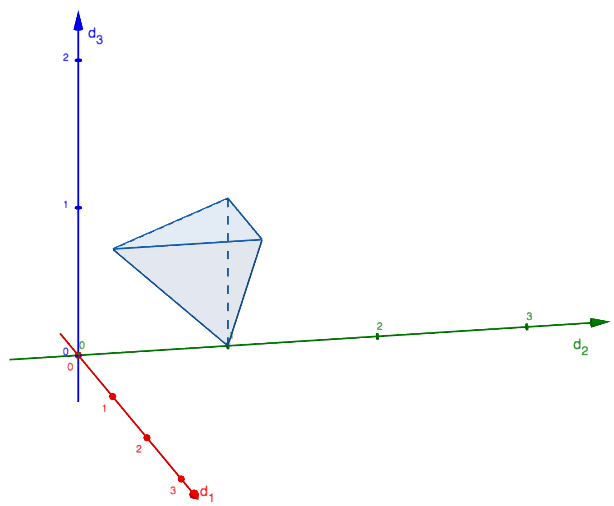


Figure 3.4: Polytope representing valid $\widehat{\text{Pol}}_{3,1}(6)$ chord lengths.

Since $\widehat{\text{Pol}}_{3,R}(n)$ is also a toric symplectic manifold, we can use Theorem 2.2.6 to help us sample the space, just as in the unconfined case. Sampling from the $(n-3)$-torus and the confined polytope in the standard way gives us an easy way to sample from the standard distribution on $\widehat{\text{Pol}}_{3,R}(n)$.

With the space of confined equilateral polygons now described and an avenue for sampling this space proposed, we now turn to the details of a specific algorithm for generating such polygons.

3.2 Algorithm for Sampling Confined Polygon Space

In this section we describe a Markov chain Monte Carlo algorithm for sampling confined polygons based on the toric symplectic structure of this space, as described in Section 3.1. This algorithm was proposed by Cantarella and Shonkwiler in [13, §5]. This section essentially collects and restates the relevant ideas from this paper. We follow the convention of the paper in calling this process the toric symplectic Markov chain Monte Carlo (TSMCMC) algorithm. This algorithm was used to generate the polygons from which the results in Chapter 4 were derived.

Pseudo-code for the TSMCMC algorithm is given in Algorithm 1. The programming-proficient reader should be able to implement this algorithm with relative ease. Alternatively, the TSMCMC algorithm is implemented as part of `plCurve` [5], a C library (with Python bindings) for working with polygonal space curves. The `plCurve` implementation was used to generate all polygons reported in this thesis.

The TSMCMC algorithm utilizes a coordinatization of (a full-measure subset of) $\widehat{\mathrm{Pol}}_{3,R}(n)$ based on the fan triangulation of a polygon, as described in Section 3.1. Under this coordinate system, each polygon is represented by a point in a convex (Theorem 2.2.5) polytope P and a point on the $(n-3)$-dimensional torus T^{n-3}. Theorem 2.2.6 tells us that the pushforward of the product of the standard measures on $\mathrm{int}(P)$ and T^{n-3} to a full-measure subset of $\widehat{\mathrm{Pol}}_{3,R}(n)$ is measure-preserving. That is, we can sample $\widehat{\mathrm{Pol}}_{3,R}(n)$ by instead sampling the simpler spaces $\mathrm{int}(P)$ and T^{n-3}. This is precisely the strategy used by the TSMCMC algorithm. A full treatment of this idea is given in [13].

We now provide a detailed textual description of the TSMCMC algorithm. Each step of the algorithm takes in two state vectors, $\vec{p}$ and $\vec{\theta}$, representing the current position within the polytope P and torus T^{n-3}, respectively. In each step, we either update our position in P, representing the chord lengths of the fan triangulation, or the position on T^{n-3}, representing the angles between adjacent triangles of the fan triangulation. The parameters β and γ determine the frequency with which we update $\vec{p}$ in proportion to $\vec{\theta}$.

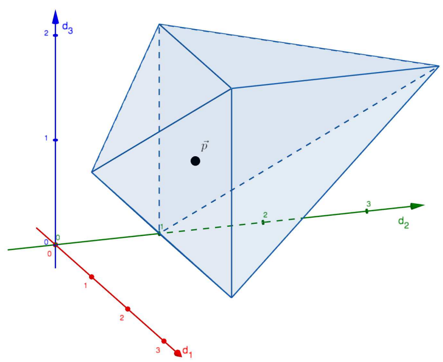
Algorithm 1 TSMCMC algorithm pseudo-code.

```
function TSMCMC(p⃗, θ⃗, β, γ)
    prob = Uniform-Random-Variate(0, 1)
    if prob < β then
        for i = 1 to γ do
            v⃗ = Random-Direction-In-Dimension(n − 3)
            (t_0, t_1) = Find-Intersection-Endpoints(P, p⃗, v⃗)
            t = Uniform-Random-Variate(t_0, t_1)
            p⃗ = p⃗ + t v⃗
        end for
    else
        for i = 1 to n − 3 do
            θ_i = Uniform-Random-Variate(−π, π)
        end for
    end if
    return (p⃗, θ⃗)
end function
```

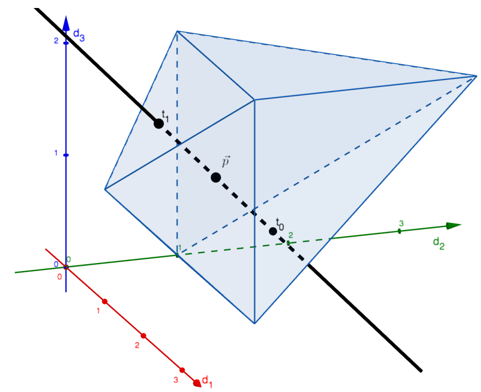
Each step of the algorithm begins by uniformly choosing a random number from the interval $(0, 1)$. This value will determine, in relation to β, whether we will update our position in the polytope, $\vec{p}$, or our position on the torus, $\vec{\theta}$.

In the steps where we update $\vec{\theta}$, we simply generate a new point on T^{n-3} by uniformly choosing a new value for each θ_i from the interval $[-\pi, \pi)$.

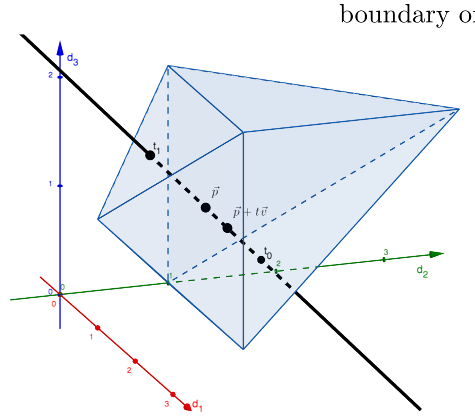
If instead we are to update $\vec{p}$, we sample a new point on the polytope by using a "hit-and-run" approach. This method is illustrated in figure Figure 3.5. The essential idea is to choose a random direction, $\vec{v}$, in the $(n-3)$-dimensional space in which the polytope sits, then consider the line through $\vec{p}$ in the direction of $\vec{v}$. Since the polytope is convex, this line necessarily intersects the polytope boundary in exactly two points. We then uniformly sample a point from the segment of the line between these two intersection points which becomes our new $\vec{p}$ position. This process is iterated γ times.



(a) We have some initial position $\vec{p}$ within the polytope



(b) The convexity property of the polytope guarantees that a line through $\vec{p}$ in any random direction will intersect the boundary of the polytope in two points



(c) Update position by sampling randomly from the resulting line segment

Figure 3.5: TSMCMC updating process illustrated in the case of $\widehat{\mathrm{Pol}}_3(6)$.

The steps where we update $\vec{p}$ require that we know the exact shape of P, in particular, its boundary. Recall that this information can be conveniently obtained by the triangle inequalities presented in Section 3.1.

Each step of the TSMCMC algorithm concludes by returning the updated $\vec{p}$ and $\vec{\theta}$ positions, which are then passed to the next iteration in the Markov chain.

In [13, Theorem 26], Cantarella and Shonkwiler prove that the pushforward of the probability measure on $\mathrm{int}(P) \times T^{n-3}$ generated by the TSMCMC algorithm converges to the symplectic measure on $\widehat{\mathrm{Pol}}_{3,R}(n)$ for any choice of starting point. That is, the TSMCMC algorithm is a provably effective way of sampling $\widehat{\mathrm{Pol}}_{3,R}(n)$.

There are still a few questions lingering. What are good choices of β and γ? What should be the starting state of $\vec{p}$ and $\vec{\theta}$? These questions are investigated in detail in [13, §5]. We summarize the relevant information here.

Cantarella and Shonkwiler write, "the data supports a general recommendation of $\beta = 0.5$ for future confined experiments, with a possible decrease to $\beta = 0.4$ in very tight confinement." Later they also mention that, "after considerable experimentation we settled on the convention that a single moment polytope step in our implementation of TSMCMC(β) would represent ten iterations of hit-and-run on the moment polytope. This reduced autocorrelations greatly and led to better convergence overall." That is, a value of 10 for γ is recommended. In Chapter 4 we follow these recommendations for all experiments and use $\beta = 0.5$ and $\gamma = 10$.

At first glance it may seem that β and γ are redundant parameters. If we want to perform 10 times as many hit-and-run steps as updates to the dihedral angles, why not let $\gamma = 1$ and $\beta = \frac{10}{11}$? Is this significantly different from $\gamma = 10$ and $\beta = 0.5$? These are valid objections. However, it is convenient to have separate parameters if one is recording $\vec{p}$ and $\vec{\theta}$ after every every TSMCMC step. In this case, setting $\gamma > 1$ will greatly reduce the amount of data one needs to record while still cataloging the significant steps.

The TSMCMC algorithm is proven to eventually converge to the symplectic measure on $\widehat{\mathrm{Pol}}_{3,R}(n)$ for an arbitrary beginning state. However, for practical implementation we would like to find an efficient starting point. Cantarella and Shonkwiler suggest, "setting each diagonal length d_i to one and choosing dihedrals randomly. This polygon is contained in spherical confinement for every $R \geq 1$ [assuming generation of unit-edge equilateral polygons]." Once again, this recommendation was followed for all results stated in Chapter 4.

The algorithm described in this section is presented as a method for sampling the space of confined polygons. In fact, the TSMCMC algorithm is applicable to any toric symplectic manifold. Every such manifold admits a moment polytope and if this polytope can be understood well enough, then the TSMCMC algorithm is a practical way to sample from the manifold. In particular, this means that we can also sample the space of unconfined and non-equilateral polygons (with fixed edge lengths) because these spaces can be represented as toric symplectic manifolds.

Chapter 4

Results

The goal of the work described in this thesis is to improve on the best-known stick number upper bounds. Recall from Chapter 1 that our strategy for doing so is to randomly generate many confined polygons in three-dimensional space, then classify them by the knots they form. The hope is that if we generate confined n-gons on a large scale, we will observe the formation of knots such that n is smaller than the lowest observed stick number upper bound; if this happens, we have found a new best-known upper bound. Indeed, this method was successful and the results are presented in this chapter.

Section 4.1 details our implementation of the method described above. The software packages and parameters used to generate the polygons are discussed, as well as the scheme which we used to identify the knot type of each polygon. The described methods were used to generate 10 billion each of 8-, 9-, 10-, and 11-gons. A table of the identified knot type of each of these polygons is presented in Appendix B. With the information given in Section 4.1, the interested reader should be able to reproduce or extend the results presented in this chapter using the same methods.

The main results of this thesis are described in the theorems of Section 4.2. These theorems detail the discovery of the precise stick number of five knots, as well as improvements to the best-known stick number upper bounds of 60 additional knots. In some sense this section is simply a readable summary of the new results included in the tables of Appendix A. The reader can refer to this appendix for the most up-to-date knowledge of stick number upper bounds, including citations of where each best-known bound is proved.

The skeptical reader can refer to Appendix C for vertex coordinates of stick knots which justify each new claim made in this thesis.

After tabulating and reviewing the results, many interesting questions concerning stick number appeared and some old questions remained. Section 4.3 notes some of these questions and speculates as to what the answers may be. In particular, we discuss: candidates for knots whose stick number and equilateral stick number differ; the effect of confinement on the types of knots generated; why different computational methods for investigating stick number yield markedly different results; and differences between stick number results of prime and composite knots.

4.1 Methodology

In this section we detail the specific methods used to generate and identify the stick knots described in the remainder of the chapter.

Knot Generation

Each knot generated for this thesis was sampled using the toric symplectic Markov chain Monte Carlo (TSMCMC) algorithm detailed in Section 3.2. Specifically, we used the implementation provided as part of the `plCurve` [5] package with the default run parameters and random initial seeds. All knots were generated in rooted confinement with unit length edges.

The confinement radius of each sample was set to 1.01. This value was chosen after experimentation showed that confinement radii closer to one generated trivial knots with the lowest frequency. Since we sampled polygons with unit length edges, we had to choose a confinement radius larger than one and thus the value of 1.01 was chosen.

How can we guarantee that the knots we are generated are truly equilateral? The representation of each knot we are considering is stored as a set of floating-point coordinates which have finite precision. It's conceivable that if a generated knot is nearly singular, adjusting its edges to have a length of precisely one might cause two edges to cross and thus change the knot type. Fortunately, the following theorem allows us to rigorously test each knot for such a defect by comparing the minimum distance between any two non-adjacent edges and the exact amount each edge differs from being unit length.

Theorem 4.1.1. *(Millett and Rawdon [30]) Let K be an n-stick knot where L_i is the length of the ith edge. Let $\mu(K)$ denote the minimum distance between any two non-adjacent edges. If*

$$|L_i - 1| \;<\; \min\left\{\frac{\mu(K)}{n},\; \frac{\mu(K)^2}{4}\right\}$$

for all $1 \leq i \leq n$, then there exists an unit-edge equilateral stick knot equivalent to K.

Calculating L_i and $\mu(K)$ for each knot K given in Appendix C, we can use the above theorem to guarantee that each K has an equivalent equilateral representation, with the single exception of the 11-stick knot which forms K12n385. In this one case, we can conclude that *stick*(K12n385) ≤ 11 but we cannot make the same claim about equilateral stick number.

To give an idea of scale, the maximal $|L_i - 1|$ value of each knot in Appendix C is on the order of 10^{-13}. For each knot, K, with crossing number ten or fewer in the same appendix, the 10_{108} knot is the closest to being singular with a $\mu(K)$ distance of 1.11×10^{-4}. In this case, $\mu(K)^2/4 = 3.08025 \times 10^{-9}$. Therefore, most of our generated stick knots which are closest to self-intersection are still several orders of magnitude away from being unable to realize an equivalent equilateral stick knot.

Knot Identification

After each iteration of the TSMCMC algorithm, we transformed the returned fan triangulation coordinates into a polygonal representation and identified the knot type of the polygon. This identification was done primarily with the Python package `pyknotid` [38] and the HOMFLY-based identification provided by `plCurve`.

One identifies knots with `pyknotid` by calculating desired knot invariants and then comparing the results against a precomputed database. The `pyknotid` database contains entries for all prime knots with crossing number 15 or fewer. Crucially, the HOMFLY polynomial is recorded for each of these knots. The hyperbolic volume (if applicable) is available for all knots with crossing number 11 and below. We used these two invariants to identify knots, aided by filtering out any candidates which had a crossing number larger than the number of crossings in a default projection of each knot. Both the HOMFLY polynomial and the hyperbolic volume of a knot are discussed in Section 2.1.

Hyperbolic volume can be calculated by `pyknotid` directly. However, the package does not have support for calculating HOMFLY polynomials. Consequently, this invariant was calculated by `plCurve` and then passed to `pyknotid`.

Since we required identification at the scale of billions of knots, speed of identification was of the utmost importance. Naively matching HOMFLY and hyperbolic volume against a database table with more than three hundred thousand entries is prohibitively slow. As a fix, we created an index on these database columns which made identification much faster.

Identification using the HOMFLY polynomial and hyperbolic volume proved to be very effective. In total, we generated ten billion each of 8-, 9-, 10-, and 11-stick knots. These two invariants were sufficient to identify: every 8-stick knot; all except a single 9-stick knot; all but 33 knots with 10-sticks; and all but 372 knots with 11-sticks. The number of knots identified of each type, plus the number of unclassifiable knots, is presented in Appendix B.

Of the roughly 400 knots which we were unable to precisely identify, many were still able to be whittled down to a handful of potential candidates. Because `pyknotid` only has hyperbolic volume recorded for knots with crossing number eleven or smaller, many of the unidentifiable knots must be one of two 12-crossing knots which have the same HOMFLY polynomial, although at the time of writing we are unable to determine which. Given a source which lists the hyperbolic volume for higher-crossing knots, it is likely that many of these knots could be definitively identified.

Other knots which we are unable to identify are so-called *mutant knots* [1]. These knots are pairs which have closely related constructions and are known to have the same HOMFLY polynomials and hyperbolic volume. Consequently, mutant knot pairs are notoriously difficult to distinguish. For example, several of the generated 11-stick knots were partially identified as either K11n34 or K11n42, a mutant knot pair. Since our identification method used only the HOMFLY polynomial and hyperbolic volume invariants, it was unable to distinguish between mutant knots.

It should be mentioned that there is one important limitation in our identification strategy. We are only checking against knots with crossing number 15 or fewer, as these are the only ones contained in the `pyknotid` database. If only one of these knots matches the computed invariants, then we are considering this a positive identification. However, it is conceivable that the knot could be a 16-crossing knot which has an identical value for each invariant, and in this case we would be misidentifying the knot. This seems very unlikely, however, and if true it would be a significant discovery. Unfortunately, much less is known about knots with more than 15 crossings and the author is not aware of a source of truth about the values of knot invariants for these knots. As we can see in Appendix B, even 14- and 15-crossing knots appear very infrequently, which suggests that we can be reasonably confident in our identification scheme.

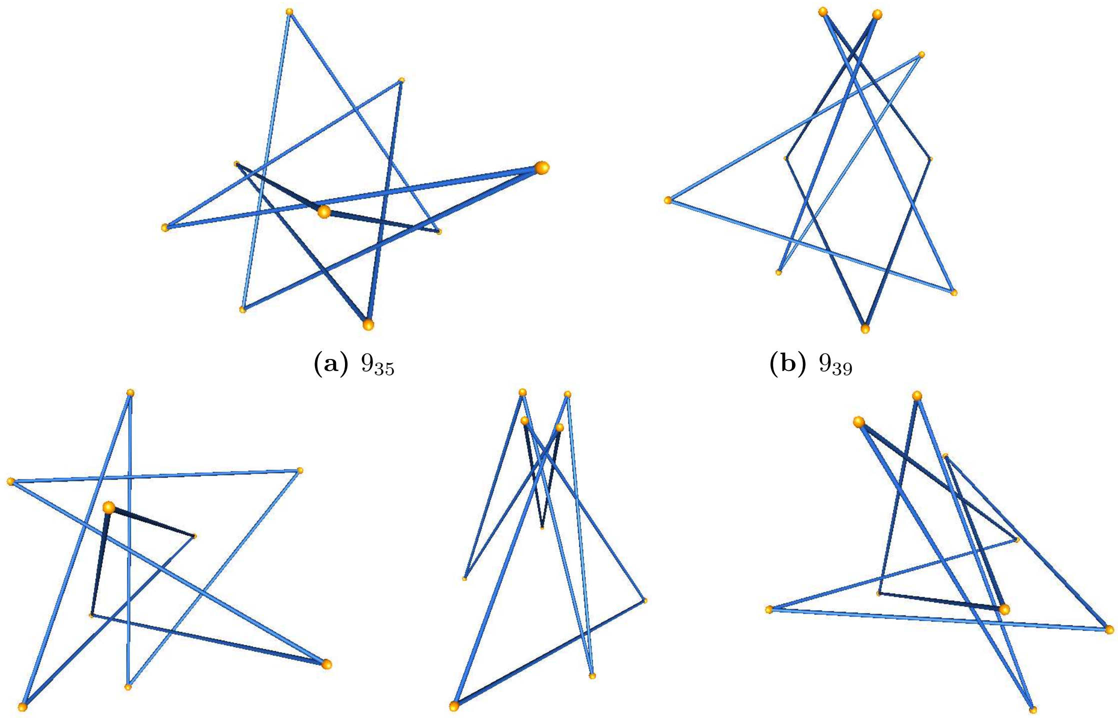
Out of an abundance of caution, we checked one representative of each type of discovered stick knot through a different software pipeline. Specifically, we used `KnotPlot` [36] to generate a Dowker code for each discovered knot and then used these codes to identify the knot with the `Mathematica` package `KnotTheory‘` [8]. All classifications done through this method matched the original identifications, further increasing our confidence in their accuracy.

4.2 Improved Stick Number Bounds

We now state the main results of this thesis.

Theorem 4.2.1. *The following knots have (equilateral) stick number precisely equal to nine:* 9_{35}, 9_{39}, 9_{43}, 9_{45}, *and* 9_{48}.

Proof of this fact is a simple combination of Calvo's result from Theorem 2.1.7, which implies that any knot with crossing number nine must have stick number at least nine, and the observed 9-stick presentations of the specified knots given in Appendix C. Each of these stick knots is equivalent to an equilateral 9-stick knot of the same type by Theorem 4.1.1. Depictions of these knots are presented in Figure 4.1.



(a) 9_{35} **(b)** 9_{39}

(c) 9_{43} **(d)** 9_{45} **(e)** 9_{48}

Figure 4.1: Equilateral 9-stick representations of the knots from Theorem 4.2.1.

Prior to the work presented here, the precise stick number was known for only 31 knots with ten or fewer crossings. Therefore, this theorem represents a significant advancement in knowledge of stick number. Moreover, our knot generation scheme yielded further improvements to the best-known upper bounds for many other knots. These results are summarized in the theorems below.

Theorem 4.2.2. *The following knots have (equilateral) stick number no greater than ten:* 9_3, 9_{11}, 9_{15}, 9_{21}, 9_{25}, 9_{27}, 10_{90}, 10_{91}, 10_{106}, 10_{110}, 10_{111}, 10_{112}, 10_{115}, 10_{117}, 10_{118}, 10_{126}, 10_{131}, 10_{133}, 10_{137}, 10_{138}, 10_{142}, 10_{143}, 10_{147}, 10_{148}, 10_{149}, 10_{153}, *and* 10_{164}.

Theorem 4.2.3. *The following knots have (equilateral) stick number no greater than eleven:* 10_7, 10_8, 10_{10}, 10_{15}, 10_{18}, 10_{20}, 10_{21}, 10_{23}, 10_{24}, 10_{26}, 10_{28}, 10_{30}, 10_{31}, 10_{34}, 10_{38}, 10_{39}, 10_{43}, 10_{44}, 10_{50}, 10_{53}, 10_{57}, 10_{64}, 10_{70}, 10_{71}, 10_{72}, 10_{73}, 10_{78}, 10_{82}, 10_{84}, 10_{95}, 10_{97}, 10_{100}, 10_{101}, *and* 10_{105}.

As in Theorem 4.2.1, proof of these upper bounds is by the observation of stick knots of the specified types which have the relevant number of edges. Again, coordinates of knots which serve as proof can be found in Appendix C and we can guarantee equivalent equilateral stick knots by Theorem 4.1.1.

The knot 10_{147} was previously known by Rawdon and Scharein [34] to have a stick number bounded above by ten. Theorem 4.2.2 presents an upper bound on equilateral stick number, which was previously only shown to be a maximum of eleven. The equilateral 10_{147} knot is visualized in Figure 4.2. All other knots mentioned are improvements to the best-known upper bounds of both stick number and equilateral stick number.

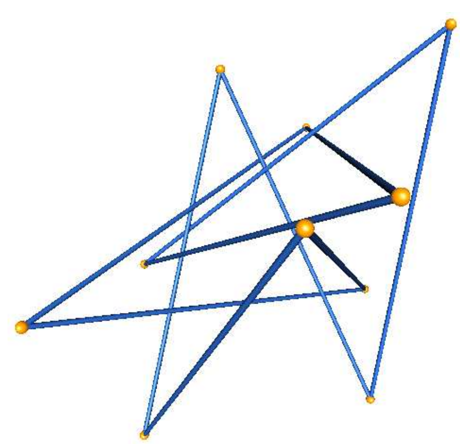
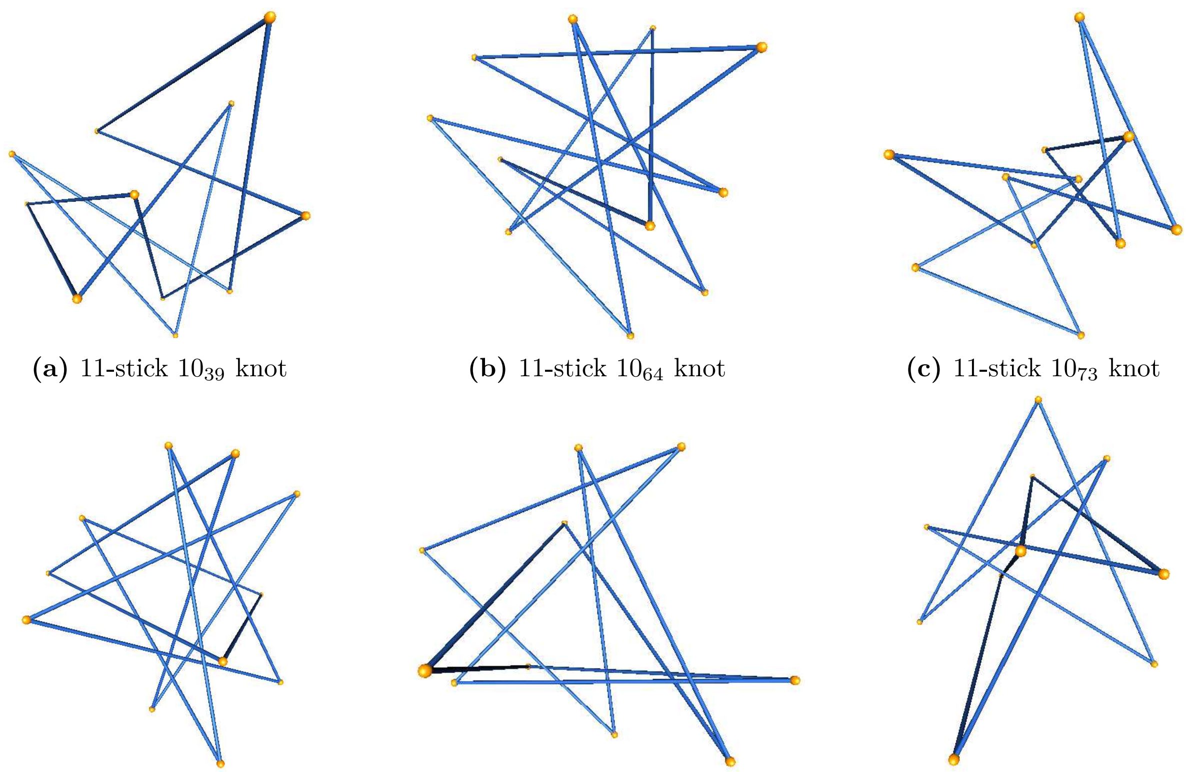


Figure 4.2: Equilateral 10-stick 10_{147} knot.

The three preceding theorems present improvements to the stick number upper bounds of 65 knots. This is an improvement to more than one-quarter of knots with crossing number ten or fewer. We take this as evidence that generating random polygons in confinement is a productive method for investigating stick number.

Furthermore, our method has reduced the best-known upper bound for the knots 10_{39}, 10_{64}, 10_{73}, 10_{110}, 10_{117} by two and has improved the best-known upper bound of the 10_{84} knot by three. Visualizations of these knots are presented in Figure 4.3. The previous best-known stick number bounds for these knots were again due to Rawdon and Scharein [34]. This suggests that our method of sampling random polygons is doing something noticeably different from their iterative vertex deletion method described in Section 2.1.



(a) 11-stick 10_{39} knot **(b)** 11-stick 10_{64} knot **(c)** 11-stick 10_{73} knot

(d) 11-stick 10_{84} knot **(e)** 10-stick 10_{110} knot **(f)** 10-stick 10_{117} knot

Figure 4.3: Knots whose best-known stick number bounds have been significantly improved.

In addition to the above results, we observed many knots with crossing number greater than ten and thus were able to derive stick number bounds for these knots. The table of bounds is too long to be presented here but is available in Section A.2. The author is not aware of any previous work which has considered the stick number of knots with high crossing number. Therefore, this table represents a first pass at bounding the stick number of these knots. Of particular interest are the 14- and 15-crossing knots constructed with eleven sticks and the several 13-crossing knots constructed with ten sticks.

Thus far, our discussion of results has been limited to prime knots. We did observe the formation of composite knots, as can be seen in Appendix B. However, none of the derived bounds were better than those discussed in [2]. In fact, we did not observe several of the composite knots which we expected to see based on the theoretical stick number upper bounds. We discuss possible reasons why in the following section.

4.3 Further Questions

We conclude this thesis by posing some open questions and examining avenues for future stick number research.

Is there a knot K such that $stick(K) < eqstick(K)$? This is one of the most intriguing open questions related to stick number. In all cases where both values are precisely known, they are the same. However, constraining all edges of a polygon to be the same length is a stringent requirement and, intuitively, it would seem that freedom to vary edge lengths should allow the flexibility to construct a wider range of knots. In [34], Rawdon and Scharein identify seven knot types for which they were unable to bound equilateral stick number as tightly as stick number. For one of these types, 8_{19}, it is shown between $[2, 21, 29]$ that its stick number and equilateral stick number are precisely equal. Another of the identified knot types, 10_{147}, is shown in Theorem 4.2.2 to have an equilateral stick number upper bound which is the same as the best-known stick number bound from [34]. However, the other five knot types, 9_{29}, 10_{16}, 10_{79}, 10_{107}, and 10_{119}, remain as leading candidates for knots whose images under these two invariants differ. Particularly appealing is 9_{29} because it is known precisely that $stick(9_{29}) = 9$. If we can show that $eqstick(9_{29}) > 9$, then it would follow that stick number is not equivalent to equilateral stick number.

Based on the frequency of knot types observed in Appendix B, it appears that composite knots may also be good candidates for instances where stick number differs from equilateral stick number. Many of the minimal composite stick knots we observed were no better than the theoretical upper bound of Theorem 2.1.9, despite the remark in [2] that the authors were able to construct composite stick knots with fewer sticks than this bound for “every knot composition [they] attempted.” The reason for this discrepancy could be that we exclusively generated equilateral stick knots. Perhaps allowing edge lengths to vary is particularly advantageous when constructing composite stick knots.

A future experiment which could shed light on this question would be to use the algorithm described in Section 3.2 to generate non-equilateral polygons. The algorithm can be modified to do this, as described in [13], although the precise lengths and order of edges must be prescribed at the start. Will we see a significantly different spectrum of knots from those in Appendix B if we generate polygons with varying edge lengths?

Similarly, it is not clear what effect the radius of confinement has on the frequency with which particular knot types appear. All of the polygons generated for this thesis were done in the tightest spherical confinement possible. Perhaps this prohibits the formation of some particular types of stick knots. Experimenting with looser confinement radii and comparing the frequency of knot types generated would be an interesting next step. The author intends to perform such experiments following this work.

Based on the results of Rawdon and Scharein [34], there were many n-stick knots that we expected to randomly generate but which were not present in our samples. Conversely, there were 65 knots which we observed that their method did not produce. It appears that each of these methods has a different “blind spot”. Is there a pattern to which sets of knots each method overlooks? Would our generation method be improved by considering looser confinement radii?

Additionally, we note an interesting pattern in the table in Appendix B. We see that knots of type 9_{35}, 9_{40}, and 9_{41} all appeared with greater frequency as 9-gons and 11-gons than as 10-gons. Does the parity of n change the frequency with which certain knot types occur when generating random n-gons? Does it depend on confinement radius? Is there a particular confinement radius for which a knot can be constructed with n equal-length sticks but cannot be made with $n + 1$ sticks?

The questions posed above are interesting to ponder but they are overshadowed by a more fundamental question: for a given knot K, what is $stick(K)$? We still lack the answer to this basic question for the majority of knots, including many of the simplest ones. The results presented in this text have made incremental progress toward answering this question, yet far more remains to be known.

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Appendix A

Stick Number Bounds

This appendix contains contains tables representing the most up-to-date stick number upper bounds.

Section A.1 contains the best-known bounds for knots with crossing number ten and below. It also includes references to proof of each bound. Where the precise value of stick number is known, the bound is decorated with an asterisk (*). The values in the table reflect the upper bound on both stick number and equilateral stick number with the exception of the knots 9_{29}, 10_{16}, 10_{79}, 10_{107}, and 10_{119}. The minimal observed equilateral stick knots of these types contain one more edge than the minimal observed non-equilateral representations. For this reason, these table values are marked with a dagger (†).

Similarly, Section A.2 contains stick number upper bounds for selected knots with crossing number eleven or greater. All of these bounds were derived from the computational experiments detailed in Chapter 4 and therefore they contain no citations. These bounds can be substantiated by the coordinates given in Appendix C. Once again, these values serve as bounds for both stick number and equilateral stick number, except in the single case of knot K12n385, for which Theorem 4.1.1 does not guarantee an equivalent equilateral bound. The bound associated to this knot has been decorated with a double dagger (‡).

A.1 Upper Bounds for Small Crossing-Number Knots

K	$stick(K)$ upper bound	
0_1	3^*	
3_1	6^*	[33]
4_1	7^*	[33]
5_1	8^*	[28, 31]
5_2	8^*	[21]
6_1	8^*	[28, 31]
6_2	8^*	[28, 31]
6_3	8^*	[28, 31]
7_1	9^*	[10, 28]
7_2	9^*	[10, 28]
7_3	9^*	[10, 28]
7_4	9^*	[10, 28]
7_5	9^*	[10, 28]
7_6	9^*	[10, 28]
7_7	9^*	[10, 28]
8_1	10	[34]
8_2	10	[34]
8_3	10	[34]
8_4	10	[34]
8_5	10	[34]
8_6	10	[34]
8_7	10	[34]

K	$stick(K)$ upper bound	
8_8	10	[34]
8_9	10	[34]
8_{10}	10	[34]
8_{11}	10	[34]
8_{12}	10	[34]
8_{13}	10	[34]
8_{14}	10	[34]
8_{15}	10	[34]
8_{16}	9^*	[10, 34]
8_{17}	9^*	[10, 34]
8_{18}	9^*	[11, 34]
8_{19}	8^*	[2, 21, 29]
8_{20}	8^*	[28, 31]
8_{21}	9^*	[10, 28]
9_1	10	[34]
9_2	11	[34]
9_3	10	Theorem 4.2.2
9_4	10	[34]
9_5	10	[34]
9_6	11	[34]
9_7	10	[34]
9_8	10	[34]
9_9	10	[34]

K	$stick(K)$	upper bound
9_{10}	10	[34]
9_{11}	10	Theorem 4.2.2
9_{12}	10	[34]
9_{13}	10	[34]
9_{14}	10	[34]
9_{15}	10	Theorem 4.2.2
9_{16}	10	[34]
9_{17}	10	[34]
9_{18}	11	[34]
9_{19}	10	[34]
9_{20}	10	[34]
9_{21}	10	Theorem 4.2.2
9_{22}	10	[34]
9_{23}	11	[34]
9_{24}	10	[34]
9_{25}	10	Theorem 4.2.2
9_{26}	10	[34]
9_{27}	10	Theorem 4.2.2
9_{28}	10	[34]
9_{29}	$9^{*\dagger}$	[10, 34]
9_{30}	10	[34]
9_{31}	10	[34]
9_{32}	10	[34]
9_{33}	10	[34]
9_{34}	9^{*}	[10, 34]
9_{35}	9^{*}	[10], Theorem 4.2.1
9_{36}	11	[34]
9_{37}	10	[34]
9_{38}	10	[34]
9_{39}	9^{*}	[10], Theorem 4.2.1
9_{40}	9^{*}	[10]
9_{41}	9^{*}	[10]
9_{42}	9^{*}	[10]
9_{43}	9^{*}	[10], Theorem 4.2.1
9_{44}	9^{*}	[10, 34]
9_{45}	9^{*}	[10], Theorem 4.2.1
9_{46}	9^{*}	[10]
9_{47}	9^{*}	[10, 34]
9_{48}	9^{*}	[10], Theorem 4.2.1
9_{49}	9^{*}	[10, 34]
10_{1}	11	[34]
10_{2}	11	[34]
10_{3}	12	[34]
10_{4}	11	[34]
10_{5}	11	[34]
10_{6}	12	[34]

K	$stick(K)$	upper bound	K	$stick(K)$	upper bound
10_7	11	Theorem 4.2.3	10_{30}	11	Theorem 4.2.3
10_8	11	Theorem 4.2.3	10_{31}	11	Theorem 4.2.3
10_9	11	[34]	10_{32}	11	[34]
10_{10}	11	Theorem 4.2.3	10_{33}	11	[34]
10_{11}	11	[34]	10_{34}	11	Theorem 4.2.3
10_{12}	11	[34]	10_{35}	12	[34]
10_{13}	11	[34]	10_{36}	11	[34]
10_{14}	11	[34]	10_{37}	12	[34]
10_{15}	11	Theorem 4.2.3	10_{38}	11	Theorem 4.2.3
10_{16}	$11^{\dagger}$	[34]	10_{39}	11	Theorem 4.2.3
10_{17}	11	[34]	10_{40}	11	[34]
10_{18}	11	Theorem 4.2.3	10_{41}	11	[34]
10_{19}	11	[34]	10_{42}	11	[34]
10_{20}	11	Theorem 4.2.3	10_{43}	11	Theorem 4.2.3
10_{21}	11	Theorem 4.2.3	10_{44}	11	Theorem 4.2.3
10_{22}	12	[34]	10_{45}	11	[34]
10_{23}	11	Theorem 4.2.3	10_{46}	12	[34]
10_{24}	11	Theorem 4.2.3	10_{47}	12	[34]
10_{25}	11	[34]	10_{48}	10	[34]
10_{26}	11	Theorem 4.2.3	10_{49}	11	[34]
10_{27}	11	[34]	10_{50}	11	Theorem 4.2.3
10_{28}	11	Theorem 4.2.3	10_{51}	12	[34]
10_{29}	11	[34]	10_{52}	11	[34]

K	$stick(K)$	upper bound
10_{53}	11	Theorem 4.2.3
10_{54}	12	[34]
10_{55}	12	[34]
10_{56}	11	[34]
10_{57}	11	Theorem 4.2.3
10_{58}	12	[34]
10_{59}	11	[34]
10_{60}	11	[34]
10_{61}	11	[34]
10_{62}	12	[34]
10_{63}	11	[34]
10_{64}	11	Theorem 4.2.3
10_{65}	12	[34]
10_{66}	12	[34]
10_{67}	11	[34]
10_{68}	12	[34]
10_{69}	11	[34]
10_{70}	11	Theorem 4.2.3
10_{71}	11	Theorem 4.2.3
10_{72}	11	Theorem 4.2.3
10_{73}	11	Theorem 4.2.3
10_{74}	12	[34]
10_{75}	12	[34]
10_{76}	13	[34]
10_{77}	12	[34]
10_{78}	11	Theorem 4.2.3
10_{79}	$11^{\dagger}$	[34]
10_{80}	13	[34]
10_{81}	11	[34]
10_{82}	11	Theorem 4.2.3
10_{83}	11	[34]
10_{84}	11	Theorem 4.2.3
10_{85}	11	[34]
10_{86}	11	[34]
10_{87}	11	[34]
10_{88}	11	[34]
10_{89}	11	[34]
10_{90}	10	Theorem 4.2.2
10_{91}	10	Theorem 4.2.2
10_{92}	11	[34]
10_{93}	11	[34]
10_{94}	11	[34]
10_{95}	11	Theorem 4.2.3
10_{96}	11	[34]
10_{97}	11	Theorem 4.2.3
10_{98}	11	[34]

K	$stick(K)$	upper bound
10_{99}	11	[34]
10_{100}	11	Theorem 4.2.3
10_{101}	11	Theorem 4.2.3
10_{102}	10	[34]
10_{103}	11	[34]
10_{104}	10	[34]
10_{105}	11	Theorem 4.2.3
10_{106}	10	Theorem 4.2.2
10_{107}	$10^{\dagger}$	[34]
10_{108}	10	[34]
10_{109}	10	[34]
10_{110}	10	Theorem 4.2.2
10_{111}	10	Theorem 4.2.2
10_{112}	10	Theorem 4.2.2
10_{113}	10	[34]
10_{114}	10	[34]
10_{115}	10	Theorem 4.2.2
10_{116}	10	[34]
10_{117}	10	Theorem 4.2.2
10_{118}	10	Theorem 4.2.2
10_{119}	$10^{\dagger}$	[34]
10_{120}	10	[34]
10_{121}	10	[34]

K	$stick(K)$	upper bound
10_{122}	10	[34]
10_{123}	11	[34]
10_{124}	10^{*}	[2, 21]
10_{125}	10	[34]
10_{126}	10	Theorem 4.2.2
10_{127}	10	[34]
10_{128}	10	[34]
10_{129}	10	[34]
10_{130}	10	[34]
10_{131}	10	Theorem 4.2.2
10_{132}	10	[34]
10_{133}	10	Theorem 4.2.2
10_{134}	10	[34]
10_{135}	10	[34]
10_{136}	10	[34]
10_{137}	10	Theorem 4.2.2
10_{138}	10	Theorem 4.2.2
10_{139}	10	[34]
10_{140}	10	[34]
10_{141}	10	[34]
10_{142}	10	Theorem 4.2.2
10_{143}	10	Theorem 4.2.2
10_{144}	10	[34]

K	$stick(K)$	upper bound
10_{145}	10	[34]
10_{146}	10	[34]
10_{147}	10	[34], Theorem 4.2.2
10_{148}	10	Theorem 4.2.2
10_{149}	10	Theorem 4.2.2
10_{150}	10	[34]
10_{151}	10	[34]
10_{152}	11	[34]
10_{153}	10	Theorem 4.2.2
10_{154}	11	[34]
10_{155}	10	[34]
10_{156}	10	[34]
10_{157}	10	[34]
10_{158}	10	[34]
10_{159}	10	[34]
10_{160}	10	[34]
10_{161}	10	[34]
10_{162}	10	[34]
10_{163}	10	[34]
10_{164}	10	Theorem 4.2.2
10_{165}	10	[34]

A.2 Upper Bounds for Large Crossing-Number Knots

K	$stick(K)$ upper bound
K11a66	11
K11a71	11
K11a72	11
K11a81	11
K11a125	11
K11a170	11
K11a215	11
K11a228	11
K11a261	11
K11a267	11
K11a269	10
K11a270	11
K11a277	11
K11a281	11
K11a285	11
K11a288	11
K11a301	10
K11a313	11
K11a315	11
K11a316	11
K11a326	11
K11a344	11

K	$stick(K)$ upper bound
K11a345	11
K11a350	11
K11a351	11
K11a352	11
K11n1	11
K11n3	11
K11n4	10
K11n5	11
K11n7	11
K11n8	11
K11n10	11
K11n11	11
K11n12	10
K11n13	11
K11n15	11
K11n16	11
K11n18	11
K11n19	10
K11n20	10
K11n21	11
K11n22	10
K11n23	11
K11n24	10

K	$stick(K)$ upper bound
K11n25	10
K11n26	11
K11n28	10
K11n29	11
K11n30	11
K11n32	11
K11n33	11
K11n38	10
K11n48	10
K11n49	10
K11n50	10
K11n51	10
K11n52	11
K11n53	11
K11n54	10
K11n55	11
K11n56	11
K11n57	10
K11n58	11
K11n59	11
K11n60	11
K11n61	10
K11n62	10

K	$stick(K)$ upper bound
K11n63	11
K11n64	11
K11n65	10
K11n66	11
K11n67	11
K11n68	11
K11n69	11
K11n70	10
K11n79	10
K11n82	10
K11n83	10
K11n84	10
K11n85	10
K11n86	10
K11n87	11
K11n88	10
K11n89	11
K11n90	11
K11n91	10
K11n92	10
K11n93	11
K11n94	10
K11n95	10

K	$stick(K)$ upper bound
K11n96	10
K11n97	11
K11n98	10
K11n99	11
K11n100	10
K11n101	10
K11n102	10
K11n103	11
K11n104	10
K11n105	11
K11n106	10
K11n107	10
K11n108	11
K11n109	11
K11n110	10
K11n111	10
K11n112	10
K11n113	10
K11n114	10
K11n115	11
K11n116	10
K11n117	11
K11n118	10

K	$stick(K)$ upper bound
K11n119	11
K11n120	10
K11n121	10
K11n122	10
K11n123	11
K11n124	10
K11n125	10
K11n126	11
K11n127	11
K11n128	10
K11n129	11
K11n130	10
K11n131	10
K11n132	10
K11n133	10
K11n134	10
K11n135	10
K11n138	10
K11n139	10
K11n140	11
K11n141	10
K11n142	11
K11n143	10

K	$stick(K)$ upper bound
K11n144	11
K11n145	10
K11n146	10
K11n147	10
K11n149	10
K11n150	11
K11n153	11
K11n154	11
K11n155	11
K11n156	10
K11n157	10
K11n158	11
K11n159	10
K11n160	10
K11n161	11
K11n163	11
K11n164	10
K11n165	10
K11n166	10
K11n167	11
K11n168	11
K11n169	11
K11n170	11

K	$stick(K)$ upper bound
K11n171	11
K11n172	10
K11n173	10
K11n174	10
K11n175	11
K11n176	10
K11n177	10
K11n178	11
K11n179	11
K11n180	11
K11n181	11
K11n182	11
K11n183	11
K11n184	10
K11n185	11
K12n4	11
K12n35	11
K12n41	11
K12n45	11
K12n53	11
K12n119	11
K12n121	10
K12n152	11

K	$stick(K)$ upper bound
K12n153	11
K12n156	11
K12n172	11
K12n176	11
K12n189	11
K12n199	11
K12n200	11
K12n238	11
K12n242	11
K12n253	11
K12n254	11
K12n274	10
K12n280	11
K12n282	11
K12n284	11
K12n285	11
K12n286	11
K12n287	11
K12n293	11
K12n296	11
K12n299	11
K12n309	11
K12n310	11

K	$stick(K)$ upper bound
K12n311	11
K12n313	11
K12n318	11
K12n321	11
K12n323	11
K12n328	11
K12n347	11
K12n349	11
K12n352	11
K12n356	11
K12n358	10
K12n363	11
K12n368	11
K12n370	11
K12n371	10
K12n374	11
K12n375	11
K12n377	11
K12n382	11
K12n385	11[‡]
K12n390	11
K12n393	11
K12n394	11

K	$stick(K)$ upper bound
K12n395	11
K12n396	11
K12n401	11
K12n403	11
K12n406	11
K12n407	10
K12n409	11
K12n411	11
K12n425	11
K12n426	11
K12n430	11
K12n432	11
K12n435	11
K12n436	11
K12n439	11
K12n442	11
K12n443	10
K12n451	11
K12n452	11
K12n454	11
K12n464	11
K12n465	11
K12n475	10

K	$stick(K)$ upper bound
K12n477	11
K12n483	11
K12n484	10
K12n487	11
K12n488	10
K12n490	11
K12n492	11
K12n502	11
K12n521	11
K12n526	11
K12n530	11
K12n535	11
K12n536	11
K12n548	11
K12n550	11
K12n552	11
K12n562	11
K12n563	11
K12n566	11
K12n567	11
K12n579	11
K12n591	11
K12n593	11

K	$stick(K)$ upper bound
K12n599	11
K12n603	10
K12n609	10
K12n614	11
K12n617	11
K12n629	11
K12n638	11
K12n639	11
K12n646	11
K12n650	11
K12n657	11
K12n660	11
K12n661	11
K12n662	10
K12n699	11
K12n703	11
K12n709	11
K12n725	11
K12n729	11
K12n730	10
K12n731	11
K12n738	11
K12n758	11

K	$stick(K)$ upper bound
K12n764	11
K12n781	11
K12n782	11
K12n801	11
K12n807	11
K12n811	11
K12n812	10
K12n824	11
K12n826	11
K12n829	11
K12n830	11
K12n831	11
K12n841	11
K12n850	11
K12n851	11
K12n859	11
K12n883	11
K12n885	11
K12n887	11
K13n62	11
K13n468	11
K13n469	10
K13n588	11

K	$stick(K)$ upper bound
K13n592	11
K13n604	11
K13n628	11
K13n725	11
K13n1192	11
K13n1394	11
K13n1466	11
K13n1642	11
K13n1644	10
K13n1692	11
K13n1697	11
K13n1700	11
K13n1708	11
K13n1718	11
K13n1719	11
K13n1720	11
K13n1735	11
K13n1756	11
K13n1757	11
K13n1762	11
K13n1786	11
K13n1860	11
K13n1861	11

K	$stick(K)$ upper bound
K13n1868	11
K13n1911	11
K13n1916	11
K13n1926	11
K13n1945	11
K13n1965	11
K13n2000	11
K13n2046	11
K13n2102	11
K13n2104	11
K13n2118	11
K13n2149	11
K13n2180	11
K13n2255	11
K13n2261	11
K13n2264	11
K13n2267	11
K13n2280	11
K13n2303	10
K13n2308	11
K13n2436	10
K13n2442	11
K13n2490	11

K	$stick(K)$ upper bound
K13n2491	10
K13n2492	11
K13n2498	11
K13n2522	11
K13n2527	11
K13n2568	11
K13n2588	11
K13n2633	11
K13n2769	11
K13n2868	10
K13n2872	10
K13n3021	11
K13n3054	11
K13n3158	11
K13n3180	11
K13n3232	11
K13n3352	11
K13n3354	11
K13n3393	11
K13n3582	11
K13n3602	11
K13n3950	11
K13n3956	11

K	$stick(K)$ upper bound
K13n3958	10
K13n3960	11
K13n3975	11
K13n3998	11
K13n4024	10
K13n4031	11
K13n4066	11
K13n4075	10
K13n4147	11
K13n4304	11
K13n4548	11
K13n4607	11
K13n4629	11
K13n4806	11
K14n6809	11
K14n7228	11
K14n7243	11
K14n7739	11
K14n10375	11
K14n13229	11
K14n13823	11
K14n19201	11
K14n22175	11

K	$stick(K)$ upper bound
K14n23230	11
K15n14178	11

Appendix B

Knot Frequency Counts

Over the course of the computational experiments described in this thesis, 40 billion random stick knots were generated. Specifically, 10 billion polygons, thought of as stick knots, were sampled from each of the spaces of confined 8-, 9-, 10-, and 11-gons. Every generated polygon was classified by knot type and recorded. The table included in this appendix gives the number of knots of each type which were observed in these samples. Any polygons whose knot type was not able to be identified are counted in the last row of the table. All prime knots appear first in the table, ordered by crossing number. Composite knots are then listed after, in order of the crossing number of the component knots.

The knots represented in this table were sampled using the algorithm described in Chapter 3. For reference, we generated unit-edge equilateral polygons using the parameter values $\beta = 0.5$, $\gamma = 10$, and a confinement radius of 1.01.

B.1 Frequency of Knots Generated in Confinement

K	8-gons	9-gons	10-gons	11-gons
0_1	9729615231	9525426022	9287154233	8994639264
3_1	255242347	425719343	609107497	812232112
4_1	14368312	37338635	71140636	117747489
5_1	146367	4599537	11407564	24165188
5_2	414395	6215682	16863799	36467607
6_1	22564	101010	879581	2979141
6_2	89577	229729	1326269	3959095
6_3	85011	178436	805814	2381842
7_1	0	779	5184	101554
7_2	0	1570	11531	145471
7_3	0	2344	11959	173476
7_4	0	3860	14550	107661
7_5	0	1668	16507	187177
7_6	0	7179	37714	216484
7_7	0	8141	37634	151253
8_1	0	0	346	2304
8_2	0	0	1031	6065
8_3	0	0	326	1187
8_4	0	0	1571	5343
8_5	0	0	303	1391
8_6	0	0	539	3578
8_7	0	0	1645	8740
8_8	0	0	1451	7934

K	8-gons	9-gons	10-gons	11-gons
8_9	0	0	1105	3963
8_{10}	0	0	1011	4870
8_{11}	0	0	1158	6529
8_{12}	0	0	182	1617
8_{13}	0	0	2233	10089
8_{14}	0	0	1255	7845
8_{15}	0	0	411	3105
8_{16}	0	938	2657	8193
8_{17}	0	733	2035	6867
8_{18}	0	13	274	846
8_{19}	26	68577	250025	682945
8_{20}	9618	33020	231524	806119
8_{21}	0	14976	108305	393589
9_1	0	0	0	35
9_2	0	0	0	48
9_3	0	0	1	81
9_4	0	0	0	88
9_5	0	0	3	201
9_6	0	0	0	43
9_7	0	0	1	63
9_8	0	0	19	205
9_9	0	0	0	99
9_{10}	0	0	0	69
9_{11}	0	0	1	123

K	8-gons	9-gons	10-gons	11-gons
9_{12}	0	0	20	161
9_{13}	0	0	2	208
9_{14}	0	0	8	253
9_{15}	0	0	1	50
9_{16}	0	0	0	30
9_{17}	0	0	45	197
9_{18}	0	0	0	49
9_{19}	0	0	29	260
9_{20}	0	0	45	303
9_{21}	0	0	27	192
9_{22}	0	0	10	179
9_{23}	0	0	0	40
9_{24}	0	0	18	120
9_{25}	0	0	4	88
9_{26}	0	0	18	408
9_{27}	0	0	99	491
9_{28}	0	0	7	120
9_{29}	0	0	53	138
9_{30}	0	0	16	274
9_{31}	0	0	46	291
9_{32}	0	0	74	429
9_{33}	0	0	82	449
9_{34}	0	5	36	209
9_{35}	0	2	0	20

K	8-gons	9-gons	10-gons	11-gons
9_{36}	0	0	0	66
9_{37}	0	0	4	75
9_{38}	0	0	10	91
9_{39}	0	5	16	149
9_{40}	0	55	33	160
9_{41}	0	103	19	185
9_{42}	0	2272	21361	93190
9_{43}	0	188	2318	20844
9_{44}	0	1130	8744	44197
9_{45}	0	2	1546	20128
9_{46}	0	1344	11060	46178
9_{47}	0	154	1112	4419
9_{48}	0	52	575	5023
9_{49}	0	263	728	6078
10_7	0	0	0	2
10_8	0	0	0	1
10_9	0	0	0	2
10_{10}	0	0	0	3
10_{12}	0	0	0	3
10_{14}	0	0	0	7
10_{15}	0	0	0	2
10_{16}	0	0	0	1
10_{18}	0	0	0	1
10_{19}	0	0	0	2

K	8-gons	9-gons	10-gons	11-gons
10_{20}	0	0	0	1
10_{21}	0	0	0	1
10_{23}	0	0	0	2
10_{24}	0	0	0	1
10_{25}	0	0	0	1
10_{26}	0	0	0	2
10_{28}	0	0	0	2
10_{29}	0	0	0	6
10_{30}	0	0	0	8
10_{31}	0	0	0	3
10_{33}	0	0	0	1
10_{34}	0	0	0	2
10_{36}	0	0	0	2
10_{38}	0	0	0	1
10_{39}	0	0	0	3
10_{40}	0	0	0	3
10_{41}	0	0	0	1
10_{42}	0	0	0	3
10_{43}	0	0	0	5
10_{44}	0	0	0	12
10_{45}	0	0	0	5
10_{48}	0	0	0	3
10_{49}	0	0	0	2
10_{50}	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
10_{53}	0	0	0	4
10_{57}	0	0	0	2
10_{59}	0	0	0	2
10_{60}	0	0	0	1
10_{63}	0	0	0	1
10_{64}	0	0	0	2
10_{67}	0	0	0	5
10_{70}	0	0	0	1
10_{71}	0	0	0	2
10_{72}	0	0	0	2
10_{73}	0	0	0	3
10_{78}	0	0	0	1
10_{82}	0	0	0	7
10_{84}	0	0	0	6
10_{85}	0	0	0	16
10_{86}	0	0	0	20
10_{87}	0	0	0	9
10_{88}	0	0	0	3
10_{89}	0	0	0	1
10_{90}	0	0	3	9
10_{91}	0	0	8	13
10_{92}	0	0	0	4
10_{93}	0	0	0	12
10_{94}	0	0	0	8

K	8-gons	9-gons	10-gons	11-gons
10_{95}	0	0	0	5
10_{97}	0	0	0	1
10_{98}	0	0	0	1
10_{100}	0	0	0	6
10_{101}	0	0	0	2
10_{102}	0	0	2	13
10_{103}	0	0	0	3
10_{104}	0	0	0	5
10_{105}	0	0	0	9
10_{106}	0	0	1	14
10_{107}	0	0	0	5
10_{108}	0	0	1	8
10_{109}	0	0	0	2
10_{110}	0	0	1	2
10_{111}	0	0	2	4
10_{112}	0	0	5	13
10_{113}	0	0	0	2
10_{114}	0	0	0	5
10_{115}	0	0	1	2
10_{116}	0	0	0	7
10_{117}	0	0	2	6
10_{118}	0	0	2	8
10_{119}	0	0	0	14
10_{120}	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
10_{121}	0	0	7	20
10_{122}	0	0	0	3
10_{124}	0	0	51	9268
10_{125}	0	0	256	1009
10_{126}	0	0	46	378
10_{127}	0	0	14	259
10_{128}	0	0	20	2410
10_{130}	0	0	24	314
10_{131}	0	0	13	216
10_{132}	0	0	437	8716
10_{133}	0	0	188	1284
10_{134}	0	0	5	402
10_{135}	0	0	21	249
10_{136}	0	0	267	1989
10_{137}	0	0	43	477
10_{138}	0	0	1	96
10_{139}	0	0	28	2814
10_{140}	0	0	255	4248
10_{141}	0	0	346	1249
10_{142}	0	0	26	1382
10_{143}	0	0	199	1383
10_{144}	0	0	26	215
10_{145}	0	0	58	2546
10_{146}	0	0	221	910

K	8-gons	9-gons	10-gons	11-gons
10_{147}	0	0	155	1004
10_{148}	0	0	123	1175
10_{149}	0	0	27	507
10_{150}	0	0	97	877
10_{151}	0	0	52	508
10_{152}	0	0	0	22
10_{153}	0	0	3	28
10_{154}	0	0	0	18
10_{155}	0	0	202	954
10_{156}	0	0	162	1110
10_{157}	0	0	21	179
10_{158}	0	0	85	387
10_{159}	0	0	111	1085
10_{160}	0	0	193	2285
10_{161}	0	0	170	5887
10_{162}	0	0	76	251
10_{163}	0	0	60	328
10_{164}	0	0	170	427
10_{165}	0	0	47	180
K11a66	0	0	0	1
K11a71	0	0	0	1
K11a72	0	0	0	1
K11a81	0	0	0	1
K11a125	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
K11a170	0	0	0	1
K11a215	0	0	0	1
K11a228	0	0	0	1
K11a261	0	0	0	2
K11a267	0	0	0	1
K11a269	0	0	1	0
K11a270	0	0	0	1
K11a277	0	0	0	1
K11a281	0	0	0	1
K11a285	0	0	0	1
K11a288	0	0	0	1
K11a301	0	0	1	2
K11a313	0	0	0	2
K11a315	0	0	0	1
K11a316	0	0	0	1
K11a326	0	0	0	1
K11a344	0	0	0	1
K11a345	0	0	0	1
K11a350	0	0	0	1
K11a351	0	0	0	1
K11a352	0	0	0	1
K11n1	0	0	0	2
K11n3	0	0	0	2
K11n4	0	0	11	45

K	8-gons	9-gons	10-gons	11-gons
K11n5	0	0	0	18
K11n7	0	0	0	2
K11n8	0	0	0	5
K11n10	0	0	0	1
K11n11	0	0	0	11
K11n12	0	0	68	379
K11n13	0	0	0	10
K11n15	0	0	0	4
K11n16	0	0	0	1
K11n18	0	0	0	4
K11n19	0	0	48	355
K11n20	0	0	12	75
K11n21	0	0	0	38
K11n22	0	0	1	2
K11n23	0	0	0	9
K11n24	0	0	13	85
K11n25	0	0	1	17
K11n26	0	0	0	7
K11n28	0	0	2	51
K11n29	0	0	0	4
K11n30	0	0	0	5
K11n32	0	0	0	1
K11n33	0	0	0	15
K11n38	0	0	109	635

K	8-gons	9-gons	10-gons	11-gons
K11n48	0	0	1	59
K11n49	0	0	3	28
K11n50	0	0	22	95
K11n51	0	0	2	84
K11n52	0	0	0	14
K11n53	0	0	0	16
K11n54	0	0	1	41
K11n55	0	0	0	11
K11n56	0	0	0	24
K11n57	0	0	14	206
K11n58	0	0	0	23
K11n59	0	0	0	10
K11n60	0	0	0	8
K11n61	0	0	7	89
K11n62	0	0	1	16
K11n63	0	0	0	4
K11n64	0	0	0	7
K11n65	0	0	4	15
K11n66	0	0	0	1
K11n67	0	0	0	2
K11n68	0	0	0	5
K11n69	0	0	0	6
K11n70	0	0	3	29
K11n79	0	0	2	22

K	8-gons	9-gons	10-gons	11-gons
K11n82	0	0	54	246
K11n83	0	0	3	30
K11n84	0	0	4	60
K11n85	0	0	3	46
K11n86	0	0	36	104
K11n87	0	0	0	17
K11n88	0	0	9	73
K11n89	0	0	0	2
K11n90	0	0	0	19
K11n91	0	0	2	28
K11n92	0	0	66	330
K11n93	0	0	0	8
K11n94	0	0	12	30
K11n95	0	0	17	874
K11n96	0	0	45	139
K11n97	0	0	0	1
K11n98	0	0	2	7
K11n99	0	0	0	7
K11n100	0	0	1	26
K11n101	0	0	1	31
K11n102	0	0	1	23
K11n103	0	0	0	1
K11n104	0	0	4	24
K11n105	0	0	0	3

K	8-gons	9-gons	10-gons	11-gons
K11n106	0	0	9	50
K11n107	0	0	2	31
K11n108	0	0	0	6
K11n109	0	0	0	1
K11n110	0	0	16	94
K11n111	0	0	33	167
K11n112	0	0	5	38
K11n113	0	0	2	28
K11n114	0	0	1	16
K11n115	0	0	0	4
K11n116	0	0	3	43
K11n117	0	0	0	22
K11n118	0	0	17	1632
K11n119	0	0	0	4
K11n120	0	0	1	70
K11n121	0	0	3	19
K11n122	0	0	2	52
K11n123	0	0	0	4
K11n124	0	0	1	18
K11n125	0	0	3	29
K11n126	0	0	0	8
K11n127	0	0	0	14
K11n128	0	0	2	48
K11n129	0	0	0	12

K	8-gons	9-gons	10-gons	11-gons
K11n130	0	0	4	57
K11n131	0	0	1	23
K11n132	0	0	21	137
K11n133	0	0	1	15
K11n134	0	0	1	42
K11n135	0	0	7	43
K11n138	0	0	3	21
K11n139	0	0	14	87
K11n140	0	0	0	2
K11n141	0	0	1	17
K11n142	0	0	0	13
K11n143	0	0	31	138
K11n144	0	0	0	10
K11n145	0	0	46	126
K11n146	0	0	1	12
K11n147	0	0	1	29
K11n149	0	0	3	29
K11n150	0	0	0	6
K11n153	0	0	0	13
K11n154	0	0	0	8
K11n155	0	0	0	4
K11n156	0	0	1	12
K11n157	0	0	1	19
K11n158	0	0	0	9

K	8-gons	9-gons	10-gons	11-gons
K11n159	0	0	5	17
K11n160	0	0	1	14
K11n161	0	0	0	14
K11n163	0	0	0	9
K11n164	0	0	1	14
K11n165	0	0	1	14
K11n166	0	0	5	20
K11n167	0	0	0	8
K11n168	0	0	0	2
K11n169	0	0	0	29
K11n170	0	0	0	5
K11n171	0	0	0	10
K11n172	0	0	3	31
K11n173	0	0	1	9
K11n174	0	0	1	6
K11n175	0	0	0	10
K11n176	0	0	4	27
K11n177	0	0	3	14
K11n178	0	0	0	7
K11n179	0	0	0	5
K11n180	0	0	0	2
K11n181	0	0	0	2
K11n182	0	0	0	2
K11n183	0	0	0	14

K	8-gons	9-gons	10-gons	11-gons
K11n184	0	0	1	4
K11n185	0	0	0	1
K12n4	0	0	0	1
K12n35	0	0	0	1
K12n41	0	0	0	8
K12n45	0	0	0	2
K12n53	0	0	0	1
K12n119	0	0	0	6
K12n121	0	0	12	122
K12n152	0	0	0	1
K12n153	0	0	0	1
K12n156	0	0	0	1
K12n172	0	0	0	1
K12n176	0	0	0	1
K12n189	0	0	0	1
K12n199	0	0	0	1
K12n200	0	0	0	1
K12n238	0	0	0	2
K12n242	0	0	0	248
K12n253	0	0	0	4
K12n254	0	0	0	2
K12n274	0	0	3	1
K12n280	0	0	0	9
K12n282	0	0	0	2

K	8-gons	9-gons	10-gons	11-gons
K12n284	0	0	0	2
K12n285	0	0	0	16
K12n286	0	0	0	3
K12n287	0	0	0	2
K12n293	0	0	0	5
K12n296	0	0	0	1
K12n299	0	0	0	1
K12n309	0	0	0	11
K12n310	0	0	0	3
K12n311	0	0	0	2
K12n313	0	0	0	4
K12n318	0	0	0	14
K12n321	0	0	0	5
K12n323	0	0	0	11
K12n328	0	0	0	9
K12n347	0	0	0	1
K12n349	0	0	0	1
K12n352	0	0	0	2
K12n356	0	0	0	4
K12n358	0	0	6	56
K12n363	0	0	0	1
K12n368	0	0	0	6
K12n370	0	0	0	21
K12n371	0	0	1	36

K	8-gons	9-gons	10-gons	11-gons
K12n374	0	0	0	1
K12n375	0	0	0	7
K12n377	0	0	0	2
K12n382	0	0	0	1
K12n385	0	0	0	1
K12n390	0	0	0	1
K12n393	0	0	0	2
K12n394	0	0	0	1
K12n395	0	0	0	1
K12n396	0	0	0	1
K12n401	0	0	0	1
K12n403	0	0	0	7
K12n406	0	0	0	1
K12n407	0	0	2	6
K12n409	0	0	0	3
K12n411	0	0	0	2
K12n425	0	0	0	5
K12n426	0	0	0	3
K12n430	0	0	0	6
K12n432	0	0	0	3
K12n435	0	0	0	3
K12n436	0	0	0	1
K12n439	0	0	0	2
K12n442	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
K12n443	0	0	1	12
K12n451	0	0	0	8
K12n452	0	0	0	3
K12n454	0	0	0	1
K12n464	0	0	0	3
K12n465	0	0	0	1
K12n475	0	0	1	12
K12n477	0	0	0	1
K12n483	0	0	0	6
K12n484	0	0	1	5
K12n487	0	0	0	20
K12n488	0	0	2	30
K12n490	0	0	0	1
K12n492	0	0	0	4
K12n502	0	0	0	2
K12n521	0	0	0	1
K12n526	0	0	0	1
K12n530	0	0	0	1
K12n535	0	0	0	1
K12n536	0	0	0	3
K12n548	0	0	0	1
K12n550	0	0	0	1
K12n552	0	0	0	1
K12n562	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
K12n563	0	0	0	1
K12n566	0	0	0	1
K12n567	0	0	0	1
K12n579	0	0	0	4
K12n591	0	0	0	303
K12n593	0	0	0	1
K12n599	0	0	0	1
K12n603	0	0	1	23
K12n609	0	0	1	0
K12n614	0	0	0	3
K12n617	0	0	0	1
K12n629	0	0	0	1
K12n638	0	0	0	1
K12n639	0	0	0	1
K12n646	0	0	0	1
K12n650	0	0	0	5
K12n657	0	0	0	3
K12n660	0	0	0	1
K12n661	0	0	0	7
K12n662	0	0	3	13
K12n699	0	0	0	2
K12n703	0	0	0	5
K12n709	0	0	0	1
K12n725	0	0	0	11

K	8-gons	9-gons	10-gons	11-gons
K12n729	0	0	0	5
K12n730	0	0	3	13
K12n731	0	0	0	1
K12n738	0	0	0	1
K12n758	0	0	0	2
K12n764	0	0	0	1
K12n781	0	0	0	2
K12n782	0	0	0	4
K12n801	0	0	0	1
K12n807	0	0	0	3
K12n811	0	0	0	1
K12n812	0	0	1	0
K12n824	0	0	0	1
K12n826	0	0	0	1
K12n829	0	0	0	3
K12n830	0	0	0	7
K12n831	0	0	0	2
K12n841	0	0	0	1
K12n850	0	0	0	3
K12n851	0	0	0	1
K12n859	0	0	0	1
K12n883	0	0	0	1
K12n885	0	0	0	1
K12n887	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
K13n62	0	0	0	1
K13n468	0	0	0	1
K13n469	0	0	2	3
K13n588	0	0	0	1
K13n592	0	0	0	1
K13n604	0	0	0	2
K13n628	0	0	0	1
K13n725	0	0	0	1
K13n1192	0	0	0	2
K13n1394	0	0	0	1
K13n1466	0	0	0	2
K13n1642	0	0	0	1
K13n1644	0	0	1	1
K13n1692	0	0	0	3
K13n1697	0	0	0	2
K13n1700	0	0	0	3
K13n1708	0	0	0	1
K13n1718	0	0	0	7
K13n1719	0	0	0	1
K13n1720	0	0	0	2
K13n1735	0	0	0	10
K13n1756	0	0	0	2
K13n1757	0	0	0	1
K13n1762	0	0	0	2

K	8-gons	9-gons	10-gons	11-gons
K13n1786	0	0	0	2
K13n1860	0	0	0	2
K13n1861	0	0	0	1
K13n1868	0	0	0	1
K13n1911	0	0	0	1
K13n1916	0	0	0	1
K13n1926	0	0	0	1
K13n1945	0	0	0	6
K13n1965	0	0	0	1
K13n2000	0	0	0	2
K13n2046	0	0	0	1
K13n2102	0	0	0	7
K13n2104	0	0	0	1
K13n2118	0	0	0	1
K13n2149	0	0	0	1
K13n2180	0	0	0	2
K13n2255	0	0	0	2
K13n2261	0	0	0	2
K13n2264	0	0	0	2
K13n2267	0	0	0	1
K13n2280	0	0	0	1
K13n2303	0	0	2	2
K13n2308	0	0	0	2
K13n2436	0	0	1	2

K	8-gons	9-gons	10-gons	11-gons
K13n2442	0	0	0	5
K13n2490	0	0	0	1
K13n2491	0	0	2	7
K13n2492	0	0	0	26
K13n2498	0	0	0	3
K13n2522	0	0	0	2
K13n2527	0	0	0	1
K13n2568	0	0	0	1
K13n2588	0	0	0	1
K13n2633	0	0	0	1
K13n2769	0	0	0	4
K13n2868	0	0	1	3
K13n2872	0	0	1	0
K13n3021	0	0	0	3
K13n3054	0	0	0	1
K13n3158	0	0	0	1
K13n3180	0	0	0	1
K13n3232	0	0	0	1
K13n3352	0	0	0	1
K13n3354	0	0	0	1
K13n3393	0	0	0	3
K13n3582	0	0	0	5
K13n3602	0	0	0	4
K13n3950	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
K13n3956	0	0	0	4
K13n3958	0	0	1	0
K13n3960	0	0	0	3
K13n3975	0	0	0	1
K13n3998	0	0	0	3
K13n4024	0	0	1	5
K13n4031	0	0	0	1
K13n4066	0	0	0	1
K13n4075	0	0	2	0
K13n4147	0	0	0	4
K13n4304	0	0	0	6
K13n4548	0	0	0	1
K13n4607	0	0	0	1
K13n4629	0	0	0	1
K13n4806	0	0	0	3
K14n6809	0	0	0	1
K14n7228	0	0	0	1
K14n7243	0	0	0	1
K14n7739	0	0	0	1
K14n10375	0	0	0	1
K14n13229	0	0	0	1
K14n13823	0	0	0	2
K14n19201	0	0	0	2
K14n22175	0	0	0	1

K	8-gons	9-gons	10-gons	11-gons
K14n23230	0	0	0	1
K15n14178	0	0	0	1
$3_1 \# 3_1$	6552	41861	506514	1953931
$3_1 \# 4_1$	0	371	9944	97552
$3_1 \# 5_1$	0	0	79	1211
$3_1 \# 5_2$	0	0	118	2119
$3_1 \# 6_1$	0	0	0	57
$3_1 \# 6_2$	0	0	5	154
$3_1 \# 6_3$	0	0	4	77
$3_1 \# 7_6$	0	0	0	1
$3_1 \# 8_{19}$	0	0	0	8
$3_1 \# 8_{20}$	0	0	0	4
$4_1 \# 4_1$	0	0	17	548
$4_1 \# 5_1$	0	0	0	4
$4_1 \# 6_1$	0	0	0	1
$3_1 \# 3_1 \# 3_1$	0	0	0	3
Unclassifiable	0	1	33	372

Appendix C

Coordinates of Discovered Stick Knots

The main results of this thesis in Chapter 4 and Appendix A are derived from the observation of n-edge polygons forming particular knots. This appendix includes one coordinate representation of each knot type which supports the claims made.

The coordinates listed in this appendix represent vertices of polygonal knots. The knots are sorted by number of sticks, crossing number, and index.

Vertices in this format can be used with knot software packages such as `pyknotid` or `KnotPlot`.

C.1 9-Stick Knots

9_{35}

0.0	0.0	0.0
1.0	0.0	0.0
0.373039413313	0.779050975701	0.0
0.442548014172	−0.0184531189982	−0.599296064849
0.159464844319	−0.0797122353316	0.357840936636
0.193085510003	0.261336560536	−0.58160324461
0.778087357701	0.550303705832	0.176203344917
0.184347420828	−0.210539406698	−0.0856948136809
0.617543548828	0.561487903338	−0.550791521092

9_{48}

0.0	0.0	0.0
1.0	0.0	0.0
0.0708428191427	0.369684910784	0.0
0.343072049936	−0.452856611468	0.499316222522
0.749420517931	0.382739233799	0.129640004825
0.241684740982	−0.422147300374	−0.17754405712
0.0892671221515	0.390134951272	0.385453645479
0.407477688197	−0.307590154029	−0.256357629812
0.771735495857	−0.0372836792929	0.634849786716

9_{39}

0.0	0.0	0.0
1.0	0.0	0.0
0.370538422963	0.777031610061	0.0
0.33754116736	−0.210914428882	0.151240884879
0.0511109127593	0.430115114949	−0.560825708345
0.760865416285	0.540929163149	0.134852946959
0.233787751106	−0.041488432854	−0.483999926296
0.350378830423	0.723463942084	0.149446507352
0.734189541887	0.2378055342	−0.635935723551

9_{43}

0.0	0.0	0.0
1.0	0.0	0.0
0.261504723635	0.674258649768	0.0
0.440222873676	−0.303129022869	−0.113018406564
0.466387748912	0.48388491127	0.503361725152
0.39776756808	0.223340834972	−0.459658552459
0.131925407342	−0.115548108458	0.44282813974
0.581096648935	0.50029880314	−0.204456787631
0.72092866351	0.0736484150716	0.689084735781

9_{45}

0.0	0.0	0.0
1.0	0.0	0.0
0.00563734140651	0.10603255724	0.0
0.82668250091	−0.302787658773	0.398435536861
0.00368891890933	−0.0308059564365	−0.100270305875
0.491525985211	0.36730011702	0.676599407152
0.111110965085	0.0902036096391	−0.205728161305
0.0697850438234	0.00486955718267	0.789766824982
0.751634719124	0.572220662743	0.328037744989

C.2 10-Stick Knots

9_3

0.0	0.0	0.0
1.0	0.0	0.0
0.211969488544	0.615636185596	0.0
0.295359907253	0.224102976034	-0.916377533486
0.759740973079	0.48543398798	-0.0701764179715
-0.0728080122906	-0.0685134022896	-0.0722920205761
0.566846322109	0.478671163276	0.467551830635
0.662806396283	0.398092722411	-0.524566498514
-0.0126690313409	0.654905138558	0.166650059151
0.896764094805	0.409067826018	-0.168753287333

9_{21}

0.0	0.0	0.0
1.0	0.0	0.0
0.310378747777	0.724170234463	0.0
0.142608783143	-0.0759220422007	-0.575938875046
0.525347084251	-0.0543033262979	0.347664949106
0.416895123573	0.863822055378	-0.0334963759882
0.260406082637	-0.12123200476	0.038473608541
0.144061526231	0.628101332932	-0.613418631955
0.455078249459	0.520161502362	0.330836413491
0.705019212669	0.342519685785	-0.62098967352

9_{11}

0.0	0.0	0.0
1.0	0.0	0.0
0.0520126832641	0.318308101229	0.0
0.0130350444288	0.0746630117513	-0.969080912021
0.136294913382	0.539392031635	-0.0922491477794
0.850038215017	-0.147575289903	0.0443026684341
0.0118102845557	0.0875581588426	-0.447719889866
0.391000730841	0.466027829429	0.396658765651
-0.0532671182005	0.166635065087	-0.447728616401
0.505208650162	0.862991877419	0.00303962346386

9_{25}

0.0	0.0	0.0
1.0	0.0	0.0
0.111628538969	0.459125415573	0.0
0.564231313537	-0.42103180233	-0.143087386677
0.257978327776	0.184615832861	0.591351208918
0.549880724328	-0.36814925465	-0.189189468379
-0.237242987219	0.137785121585	0.163608872978
0.605908520009	0.575916996205	-0.148057609501
0.328605070964	-0.223036339529	0.385586808128
0.93639091101	0.220042949237	-0.27341024536

9_{15}

0.0	0.0	0.0
1.0	0.0	0.0
0.25355519844	0.665447336927	0.0
0.0667117415278	-0.312368735601	0.0946850089242
0.622625152779	0.479548357026	-0.15795623394
0.746505516191	-0.232036307801	0.533636796928
0.275468850804	0.15252516736	-0.260237835293
-0.167621890181	-0.319875873145	0.501672823631
0.341328623596	-0.107233529037	-0.332445038555
0.55510448983	-0.706453606415	0.439069820592

9_{27}

0.0	0.0	0.0
1.0	0.0	0.0
0.470469571485	0.848290943767	0.0
0.841334853695	-0.0783693063705	0.0613165823163
0.301095374992	0.160605147044	-0.745549277828
0.245289998606	-0.0990666054736	0.218533882958
0.239735282363	0.791639130807	-0.236012524447
0.364625022538	-0.136137163773	-0.587628365978
0.71984504722	0.38968557195	0.185242376554
0.654585977819	0.053039203343	-0.754124685017

10_{90}

0.0	0.0	0.0
1.0	0.0	0.0
0.281439860908	0.695464827657	0.0
0.54641285353	0.00786086055678	0.676010427145
0.11098969884	0.299524350588	−0.175657985409
0.383528048954	−0.474966930362	0.395206362269
0.487699219411	0.513699023099	0.503317414962
0.778337626491	−0.124065698587	−0.209974584224
0.0275988495307	0.102584282342	0.410526080492
0.955203791436	0.283816004557	0.0838700923088

10_{91}

0.0	0.0	0.0
1.0	0.0	0.0
0.131802050826	0.49621801766	0.0
0.701820794102	−0.182835917673	−0.462562844619
0.784687979593	0.366315812281	0.369041272167
0.275607981481	0.566563174469	−0.468060005731
0.00273864322164	−0.105049602334	0.220764066345
0.410074081052	0.470547033916	−0.488296123924
0.810414170602	−0.238755115598	0.0918920122816
0.676480094004	0.713493126383	−0.182489016164

10_{106}

0.0	0.0	0.0
1.0	0.0	0.0
0.219787801143	0.625514927684	0.0
0.178144182388	−0.295404123294	−0.387522787153
−0.0272814184896	0.379230018194	0.321468819033
0.578433045916	−0.274697894622	−0.131839323901
0.539257126754	0.630584797953	0.291160077851
0.188738648563	0.45982677415	−0.629697399587
−0.0117834928767	0.330391577563	0.341403728348
0.622993393268	0.707903293959	−0.332794468624

10_{110}

0.0	0.0	0.0
1.0	0.0	0.0
0.154264782244	0.533602793703	0.0
0.186912603914	−0.355366285642	−0.456802031201
0.80754218845	0.246652231409	0.0455848953087
0.492042157252	−0.684952590641	−0.134892764939
0.600159255803	0.304932150248	−0.226756211191
0.280195544647	−0.29394659461	0.507387829513
0.0806237166874	0.0734838041767	−0.40099864525
0.750197908176	−0.635945432012	−0.181042829384

10_{111}

0.0	0.0	0.0
1.0	0.0	0.0
0.506038616434	0.869483842027	0.0
0.0239429777387	0.246139346282	−0.615650416044
0.587426338128	−0.0877148924317	0.140013431085
0.496798189414	0.777533191904	−0.353071035528
−0.325183871004	0.42340020801	0.0929506254603
0.518601064276	−0.0931965233638	−0.0524962725135
−0.062191578979	0.716573879005	−0.135873733428
0.892020561709	0.451980012852	0.00365861607632

10_{112}

0.0	0.0	0.0
1.0	0.0	0.0
0.0330162931592	0.254838204955	0.0
0.419110486457	−0.603007928552	−0.339162623427
0.539562438108	0.200037459629	0.244454915604
0.0579276856441	−0.509033171524	−0.270566254112
0.405394629209	0.366486415437	0.0651898716371
0.570009909233	−0.594899252986	0.285733305306
0.194505043914	0.224157936092	−0.148019408969
0.892817163425	−0.320174990733	0.316805126225

10_{115}

0.0	0.0	0.0
1.0	0.0	0.0
0.129365950474	0.491931247032	0.0
0.590050432679	−0.390007091015	−0.0997726201837
−0.0186910523819	0.302475207088	0.287399268232
0.476041138315	0.676178561061	−0.497193532345
0.366691866403	0.302154122548	0.423756225312
0.582476025446	0.224372526765	−0.549581958498
0.0571485593481	−0.0628779709166	0.251366357528
0.664623367624	0.727373769252	0.170889376533

10_{117}

0.0	0.0	0.0
1.0	0.0	0.0
0.0461448414257	0.300267108524	0.0
0.324742124094	−0.656228228366	−0.0866038370814
0.693238645791	0.265767262133	0.0322853087489
0.0498305325253	−0.270473728982	−0.514040234524
0.303977106897	0.152063225188	0.355943696992
0.227172063958	−0.0187990035061	−0.626353144184
0.692340966584	−0.0898712072211	0.256011085536
0.632873514816	−0.269041730607	−0.726008031248

10_{118}

0.0	0.0	0.0
1.0	0.0	0.0
0.159033029832	0.541086458051	0.0
0.306194697991	−0.350894060596	−0.427450813284
−0.0155549285846	0.369288113056	0.187215612146
0.418846452217	−0.531431129711	0.187750463833
0.883982506297	0.349788470739	0.103486195142
0.072006292607	0.00244385857774	−0.365604786229
0.801689200985	−0.138895828473	0.30341385782
0.742704159353	0.401238479909	−0.536095340326

10_{137}

0.0	0.0	0.0
1.0	0.0	0.0
0.125551801185	0.485118900466	0.0
0.552120172471	−0.260713299522	0.511638303961
0.629222811165	−0.00143202272129	−0.451080971117
0.291012503659	0.0265416099327	0.489573728426
0.411465939124	0.499160905679	−0.383422245891
0.366403591783	−0.373685148569	0.10248839449
0.10722500373	0.571644653162	−0.0954460023532
0.979683748222	0.143479961346	0.140118714533

10_{126}

0.0	0.0	0.0
1.0	0.0	0.0
0.15635443188	0.536900507908	0.0
0.536458698325	−0.372746606748	0.167519770262
−0.336646809052	0.111442804554	0.110533921393
0.629699214209	−0.0917491556883	−0.0472266269727
0.330070427486	0.823492501741	0.222134280867
0.259005192673	−0.111517802791	0.569561198102
0.703196350479	0.00174229817708	−0.319183064808
0.728642228332	0.133276995716	0.671801864767

10_{138}

0.0	0.0	0.0
1.0	0.0	0.0
0.395711584736	0.796765656375	0.0
0.282062566712	−0.196749204994	0.00348151418862
0.364751568548	0.798796911046	−0.0418004890057
0.348032731715	−0.143619484532	−0.37582416757
0.194573135408	−0.0568596366031	0.608514636444
0.686374425049	−0.068761464065	−0.262111481939
−0.158290183724	0.279732866355	0.144205389914
0.741605317591	0.668746204064	−0.0529156637466

10_{131}

0.0	0.0	0.0
1.0	0.0	0.0
0.35569253149	0.764766556553	0.0
0.738441437663	−0.0873542465624	0.356922136777
0.121082593454	−0.107345816574	−0.429505478841
0.982011039283	0.0525536241771	0.0534379754164
0.415514706963	0.677451064288	−0.483763192499
0.29991784722	−0.263516886806	−0.165617500982
0.638421764502	0.619714860482	0.158907965764
0.879878005803	−0.13017002376	−0.45702347841

10_{142}

0.0	0.0	0.0
1.0	0.0	0.0
0.074508526621	0.378768442063	0.0
0.373612113425	−0.526296653115	0.302314766181
0.727532774577	0.238008729487	−0.236737594667
0.26702106399	−0.237614192528	0.512736754772
0.22824627213	−0.253778084629	−0.486380477643
0.805652850222	0.196645664397	0.194589484903
0.280346687841	−0.606676577623	−0.0859934996868
0.511228524963	−0.254333218275	0.820950674125

10_{133}

0.0	0.0	0.0
1.0	0.0	0.0
0.275503748152	0.689278739741	0.0
0.115835505271	−0.254136221043	−0.290644566413
0.207520193286	0.503510885708	0.35554795878
0.254883481863	−0.101533600059	−0.439233702519
0.369724681262	−0.101278861025	0.554150127644
0.0890852037569	0.282333352179	−0.325669827544
0.663424192803	−0.219400521591	0.321166972254
0.795988778852	0.256568126328	−0.548246897387

10_{143}

0.0	0.0	0.0
1.0	0.0	0.0
0.0889670862431	0.412333639243	0.0
0.491081977254	−0.0691591211047	−0.778760769531
−0.126099217677	0.362898158299	−0.121178926763
0.322091218482	−0.500367374875	0.110980398208
0.342959989944	0.432985509539	−0.247372622618
−0.152794653531	−0.381657513301	−0.548344513019
0.450825700291	0.00431376050173	0.149271888918
0.50737892038	0.350934097702	−0.787027248718

10_{147}

0.0	0.0	0.0
1.0	0.0	0.0
0.298550359007	0.712719019777	0.0
0.475872458477	−0.0511783111609	−0.6204979781
0.0833845196143	0.174932732614	0.271032735746
0.548218612071	−0.50708783173	−0.293570856434
0.302018428272	0.456778951508	−0.395287588919
0.989801868503	−0.123431504383	0.0409574869479
0.143776389231	−0.158819290348	−0.49100923478
0.791596359817	0.56110664865	−0.241939107972

10_{148}

0.0	0.0	0.0
1.0	0.0	0.0
0.191167323721	0.588038860776	0.0
0.455068865898	−0.307109380423	0.359257014287
−0.0177571346435	0.572613762737	0.409484144419
0.270163586204	−0.240494923343	−0.0964367220487
0.399653945596	0.731153118384	0.101382209884
0.143065769349	−0.055310992957	0.663197757357
0.202935341077	0.383856412992	−0.233210421952
0.753590531568	0.279482510423	0.594971290987

10_{149}

0.0	0.0	0.0
1.0	0.0	0.0
0.23449455957	0.643429421671	0.0
0.611116410005	−0.242241688995	−0.271556008048
0.12048099275	0.153408335154	0.504805985951
0.210186207741	−0.0628765645502	−0.467394516293
0.848759021499	−0.103756177885	0.301080349102
0.341634688175	0.349423216781	−0.432031747922
0.377374877041	−0.397447294311	0.231976594316
0.924508734307	0.361216209179	−0.121681758766

10_{153}

0.0	0.0	0.0
1.0	0.0	0.0
0.145200701984	0.518958726789	0.0
0.341720599674	−0.25581004685	0.600927014874
0.116354217774	0.0531717254973	−0.323053644159
0.229168175046	0.807641163427	0.323513350262
0.102044803695	−0.106467871365	−0.0615117410848
0.463541716086	0.460084800968	0.678986774649
0.0189885746264	−0.00590621531766	−0.0860131450631
0.700743473692	0.710836349474	0.0605827396504

10_{164}

0.0	0.0	0.0
1.0	0.0	0.0
0.221878953946	0.628114350805	0.0
0.115652174192	−0.358480175045	−0.123883464697
0.695075553527	0.226233739061	−0.691667038015
0.644036789784	0.477381292084	0.274935233453
0.074389715494	−0.0714769979237	−0.336830071417
0.744096756178	−0.595373346883	0.189501663524
0.3364964471	0.312577983487	0.0921036670367
0.644336828735	−0.120120008263	−0.755249120986

K11a269

0.0	0.0	0.0
1.0	0.0	0.0
0.332146417158	0.744292678914	0.0
0.187289330585	−0.205002518063	0.279025184283
0.936555500183	0.333367429185	−0.106666411419
0.0200910707293	0.630650899014	0.161131064509
0.330378443865	−0.315060618183	0.0644280536313
0.739516800579	0.594730633828	−0.00546960605171
0.23688923102	−0.269297201972	−0.0341301238681
0.789389386017	0.393692569203	0.471031377085

K11a301

0.0	0.0	0.0
1.0	0.0	0.0
0.111725536527	0.459313049609	0.0
0.419939054376	−0.45113454025	−0.275843458388
0.813304493011	0.366350731398	0.144848189172
0.0494459424231	−0.0377980983143	−0.358325576178
0.415303980985	0.322003631443	0.499981251759
0.513157319055	0.69018885742	−0.424607502012
0.484217782142	−0.162396133754	0.0971791747307
0.582415314128	0.790140552617	−0.190972010982

K11n4

0.0	0.0	0.0
1.0	0.0	0.0
0.444487220018	0.831507998324	0.0
0.734879160897	−0.119407575049	−0.106920966093
−0.0462367512909	−0.421857695869	0.439322437659
0.506860763258	−0.479447809525	−0.391801210307
0.852875775826	0.258270477049	0.187892968318
0.294491294153	0.11196766887	−0.628686641362
0.560941860622	−0.423477858332	0.172750931396
0.859833672742	0.509920970708	−0.0258197376246

K11n12

0.0	0.0	0.0
1.0	0.0	0.0
0.425801671604	0.818716238795	0.0
0.280222955695	−0.155857518702	−0.170331525774
0.176173578275	0.441362521452	0.624968386648
0.627839772866	0.325284441133	−0.259635212674
−0.355168561039	0.498938613904	−0.319123394303
0.332768788828	−0.0926536011873	0.101305973964
0.209812984406	0.822465231689	−0.282672400263
0.883740106503	0.362744112735	0.295668958184

K11n24

0.0	0.0	0.0
1.0	0.0	0.0
0.145642662791	0.519686001694	0.0
0.493469362642	−0.203286320785	−0.596931828436
0.106039977477	0.656580101466	−0.26447400044
0.600648167341	−0.146835596025	0.067016505522
0.239328172418	0.35028979249	−0.721852437562
0.577619084832	0.385178510584	0.218542179569
0.272815903008	−0.127006055807	−0.584428548603
0.871725054122	0.485224507576	−0.0682100231969

K11n19

0.0	0.0	0.0
1.0	0.0	0.0
0.482314826884	0.855571190221	0.0
0.615036402808	0.0080589003846	−0.513914294275
0.619063527359	0.0915362098238	0.482587246655
0.548099196969	0.639710637249	−0.350760736441
0.530622960379	−0.360084836487	−0.340582728147
0.63320502443	0.472678229226	0.203460097851
0.249029518414	−0.126655128999	−0.49882809534
0.92273805098	0.383783921804	0.0355582710307

K11n25

0.0	0.0	0.0
1.0	0.0	0.0
0.189137491686	0.585236697936	0.0
0.493641901276	−0.3609520581	−0.109562322411
−0.200579055653	0.309497721059	−0.371391191306
0.0677036857316	−0.629353777667	−0.587220369162
0.51650813248	−0.0105232455504	0.0574681921598
−0.210166121366	0.141555889966	−0.61246946564
0.151033455222	−0.0710912242352	0.295449071837
0.879948692472	−0.336042082305	−0.335806518009

K11n20

0.0	0.0	0.0
1.0	0.0	0.0
0.0947930189151	0.424970965355	0.0
0.335161783287	−0.515866720761	0.238845777642
0.608827822123	0.170749858014	−0.434700488728
0.626628425913	0.377997178563	0.543426132232
0.51776282277	−0.173171658623	−0.283835128415
0.00180693223424	−0.0370574046952	0.561896761075
0.35359033286	0.24255989934	−0.331446735196
0.725780043631	0.353703732544	0.590031353278

K11n28

0.0	0.0	0.0
1.0	0.0	0.0
0.167303997942	0.553730411081	0.0
0.349930744253	−0.424559259745	−0.097963214974
0.068497167698	0.521692314045	−0.257346718163
0.393706459097	−0.423598741334	−0.283109819854
0.0796553713406	0.161911697921	0.464251832763
0.0758030565012	−0.112930535434	−0.497229787672
0.448904758294	0.511051571175	0.189386153557
0.722801340092	0.105935873946	−0.682887848313

K11n22

0.0	0.0	0.0
1.0	0.0	0.0
0.350470662993	0.760336530996	0.0
0.326772936418	−0.239353427487	0.00764229431061
0.476960315176	0.747840053477	−0.0461422983065
−0.101220950799	−0.0188795304706	0.232869356051
0.731574160145	0.234019864025	−0.25956764444
0.493710859881	0.346289661992	0.70522069652
0.0871046855569	−0.102126864615	−0.0907655079247
0.879680397233	0.414427532724	0.233264268255

K11n38

0.0	0.0	0.0
1.0	0.0	0.0
0.461187196172	0.842425523374	0.0
0.885696696243	0.00330995806783	−0.340112852464
0.126625203164	−0.117836144078	0.299523052039
0.908379411538	0.319791115603	−0.144709701451
0.29619648875	−0.384702511331	−0.503765127056
0.593646050183	−0.212039655693	0.435229706096
0.765473533182	0.293680748564	−0.410182731005
0.82685516237	0.0571594191756	0.559502762514

K11n48

0.0	0.0	0.0
1.0	0.0	0.0
0.18611064642	0.581019896501	0.0
0.360386043683	−0.287844596837	0.463360095527
0.110932585445	0.25208702205	−0.340534685585
0.149922748859	−0.169322884509	0.565497023468
0.627149960834	0.0528539992937	−0.284733310297
0.0912355134819	0.496317208346	0.43369280792
0.324069617083	−0.28808445892	−0.141200490519
0.841222891589	0.527747622182	0.117586112907

K11n54

0.0	0.0	0.0
1.0	0.0	0.0
0.0304620622652	0.244941191499	0.0
0.12568640473	−0.749165193318	0.0518152513062
0.14002122196	0.155019157412	0.478717081835
0.0516677161332	−0.664454851207	−0.0875478801796
0.436094313187	0.257152740557	−0.14098605268
−0.0534063643314	−0.317034839597	0.515289582633
0.306729024913	0.1495766289	−0.292532327742
0.857040130798	−0.0899149003282	0.507343596492

K11n49

0.0	0.0	0.0
1.0	0.0	0.0
0.200851978993	0.601134294913	0.0
0.843173284698	−0.131444251784	0.225282074644
0.436539104637	0.781608827994	0.193933755496
0.333585556271	0.044137708491	−0.473551761034
0.761428712955	0.328118887077	0.38453035828
0.395862958756	−0.237437101052	−0.354731505776
0.512860361872	0.108635848293	0.576152547904
0.864063188807	0.391526752285	−0.316388381573

K11n57

0.0	0.0	0.0
1.0	0.0	0.0
0.166892728776	0.553111448656	0.0
0.722453436801	−0.27563350849	−0.0673356941328
0.460487442143	0.555430389405	0.423282910547
0.610727695293	0.00753776556712	−0.399663952304
−0.0124858871983	0.291651086987	0.328954226985
0.418242664984	0.518379053387	−0.54458303243
0.42272548286	−0.207392477066	0.143338176668
0.703465665953	0.647923375684	−0.292115312963

K11n50

0.0	0.0	0.0
1.0	0.0	0.0
0.106930563031	0.449918860187	0.0
0.663612722182	−0.0941643737963	0.627756647262
0.614526820775	0.710752031335	0.0364021384989
0.277522661462	−0.0335568515749	0.612971720967
0.725924030209	0.115393805971	−0.268362446147
0.382301170269	0.495017059056	0.590595943907
0.444219790746	0.0382326399818	−0.2968239561
0.756282393028	0.0363329148517	0.653235685871

K11n61

0.0	0.0	0.0
1.0	0.0	0.0
0.129453349531	0.492085896321	0.0
0.594734517128	−0.393035170424	0.00861001075798
0.116901217216	0.128217900167	0.71569598424
0.389695561118	−0.569533171224	0.0533315163625
0.62766437314	0.341958846566	0.388820929027
0.445853435662	−0.638879054068	0.458833754235
0.393000974206	0.168429554921	−0.128924212253
0.656497081881	−0.525613682201	0.541056224958

K11n51

0.0	0.0	0.0
1.0	0.0	0.0
0.029216811326	0.239958330941	0.0
0.743814465052	−0.383648797443	−0.316961106002
0.59793605665	0.549986357877	0.0102160428219
0.166852054847	−0.349692475701	−0.0586648674612
0.874826106797	0.315719601572	0.177977286824
0.177425124226	−0.198941157632	−0.320777334652
0.711309800674	0.0554667154996	0.485599615876
0.864396971154	0.0255534502104	−0.502160230845

K11n62

0.0	0.0	0.0
1.0	0.0	0.0
0.188363716013	0.584163112936	0.0
0.511380853815	−0.350806976386	0.146597615121
0.492433680083	0.0626994401553	−0.763706426442
0.809766761324	0.375504505849	0.131532483808
0.485603773789	−0.495054329747	−0.238664316931
0.447079872955	0.166543982926	0.510203883577
0.191470748612	0.02905665563	−0.446750248231
0.90383822318	0.401415215146	0.148129306244

K11n65

0.0	0.0	0.0
1.0	0.0	0.0
0.283707761054	0.697800421629	0.0
0.720001307526	−0.151636030199	0.296825968561
0.542231664213	0.820091237502	0.141442342903
0.775884721646	−0.136311293046	−0.0337730911051
0.244447463057	0.609865735592	0.367218532395
0.797226414851	−0.0336987971483	−0.162177465562
0.193438175323	0.212204709862	0.596091106282
0.981721687929	0.189391554977	−0.018798041221

K11n83

0.0	0.0	0.0
1.0	0.0	0.0
0.0535333320454	0.322801558935	0.0
0.413185776199	−0.374167740463	−0.620390131378
−0.151213691028	−0.229478127166	0.192332550228
0.583947166145	0.28653979247	−0.247285489321
0.210933859179	−0.260181844161	0.502352106366
0.120563224893	−0.138729009763	−0.48612265683
0.675360244764	0.372135770337	0.170548831204
0.813082570309	−0.504487561702	−0.29049790696

K11n70

0.0	0.0	0.0
1.0	0.0	0.0
0.162377661455	0.546249776174	0.0
0.38074646892	−0.350211736025	0.385579850449
0.868498281435	0.10527717009	−0.359153676253
0.191987734404	0.0657496045037	0.376217693406
0.724595080942	−0.513497150902	−0.240874366797
0.356532563961	−0.224640659659	0.642919676553
0.288172989433	0.0423847763662	−0.31834219468
0.819025002909	−0.417680727647	0.393371140734

K11n84

0.0	0.0	0.0
1.0	0.0	0.0
0.310654564655	0.724432792444	0.0
0.776355326591	−0.160437779889	0.0112636828098
0.46684179222	0.710964739883	−0.369339812413
0.967650101817	−0.00438970620763	0.117957892791
0.495823342355	0.398910030396	−0.666088554501
0.603045762374	0.291136445748	0.322287996767
0.236544011165	−0.364484254166	−0.337892254531
0.986249463819	0.130809596238	0.100999230933

K11n79

0.0	0.0	0.0
1.0	0.0	0.0
0.180444616838	0.572999977252	0.0
0.35565889909	−0.405733727565	−0.106678443705
−0.153493675256	0.422314001399	0.12805675731
−0.0664340145021	−0.540512071025	0.383764734756
0.407346395261	0.086491150336	−0.234619517734
0.459218938188	0.424714411472	0.705015658766
0.0746127253199	−0.0721625019301	−0.0729248235017
0.8301108849	0.502444825096	0.241795608944

K11n85

0.0	0.0	0.0
1.0	0.0	0.0
0.247931623237	0.659085090617	0.0
0.521828988454	−0.297787474141	−0.096825245373
0.728131724883	0.534748279943	0.417298668789
0.0885929818875	0.340098036977	−0.32640925716
0.543031009153	0.00646749728979	0.499530657339
0.676416927028	−0.261988702643	−0.454481641131
0.316870095443	0.0589195602321	0.42172835808
0.631742897294	0.735952371458	−0.243464614807

K11n82

0.0	0.0	0.0
1.0	0.0	0.0
0.302742044303	0.716820300506	0.0
0.641010013627	−0.152980547018	0.359195304224
0.285401078628	0.107564455893	−0.538389559065
0.213159634498	0.417398623996	0.409652614061
0.741044924976	0.175572784982	−0.404507925195
0.286757063078	0.647712496781	0.350943351245
0.447515069438	−0.135900416366	−0.249146363499
0.648412359618	0.734402774392	0.200534228649

K11n86

0.0	0.0	0.0
1.0	0.0	0.0
0.144577423355	0.517930705178	0.0
0.943533313816	−0.0114037812871	0.285437360092
0.201030444636	0.438579516915	−0.21075264444
0.607501840979	−0.184706827787	0.457300599293
0.488847530349	−0.128000362805	−0.534014452241
0.225529495016	0.603365443227	0.0950862313034
0.553013212488	−0.280322600195	−0.239353384629
0.798502391408	0.415443383837	0.435661251137

K11n88

0.0	0.0	0.0
1.0	0.0	0.0
0.186220621587	0.581173918263	0.0
0.574854310908	−0.338453931429	0.0569953822276
0.407153309838	0.364666309528	0.748007900925
0.673041710352	−0.0415424832513	−0.126233355903
0.0342903430266	0.00447974096388	0.641802219847
0.51622111555	0.4875312299	−0.0892271841661
0.556295809603	−0.490587916229	0.114922160366
0.596854071958	0.27887367036	0.752326187745

K11n95

0.0	0.0	0.0
1.0	0.0	0.0
0.313346581751	0.726984926396	0.0
0.510407106943	−0.252897434147	−0.0315865304731
0.585378835849	0.641705106404	0.408942168143
0.0511657006673	−0.192383490184	0.271419300074
0.797015776018	0.385749557331	−0.0594429741001
0.235698665246	−0.0419250698046	0.649088969047
0.326393614148	0.178157943736	−0.322166864086
0.849288322146	0.0697220190545	0.523305060099

K11n91

0.0	0.0	0.0
1.0	0.0	0.0
0.241354708202	0.651503891955	0.0
0.46237121427	−0.208055378553	−0.460770620297
0.891819065392	0.0256866307016	0.411547679566
0.24739477891	0.371625703152	−0.270393298191
0.273468205034	−0.449565235443	0.29966425927
0.76516534656	0.135454620896	−0.345305266137
0.342290505714	0.303803783062	0.545107800129
0.984136436208	−0.166851838578	−0.0602987470169

K11n96

0.0	0.0	0.0
1.0	0.0	0.0
0.180312947994	0.572811606703	0.0
0.130047385434	−0.404553913547	0.205499423469
0.542462846156	0.45980792838	−0.0822367299384
0.33058879951	−0.206129899411	0.633050763224
0.885045795174	0.0145113632418	−0.169379840115
0.427405013462	0.463531746444	0.598048078574
0.211485976698	0.131485282894	−0.320169823455
0.827663486479	0.354279440238	0.435269148199

K11n92

0.0	0.0	0.0
1.0	0.0	0.0
0.456922265818	0.83968242487	0.0
0.752930455445	0.0292356461414	0.505524648778
0.497988317411	0.431274019843	−0.373889731549
−0.111960095084	−0.133715264416	0.181763076206
0.72255121716	−0.0199483279152	−0.357354678923
0.490230961107	0.673384000769	0.324787227595
0.0639796464117	−0.00284296030997	−0.276067924526
0.769500560952	0.638104348655	0.0263007019518

K11n98

0.0	0.0	0.0
1.0	0.0	0.0
0.163996319014	0.548723833434	0.0
0.494002318127	−0.394998499538	−0.022004517725
0.32352658729	0.581143948776	−0.156481079976
0.461676497753	−0.40907902283	−0.175796067489
0.661652464518	0.526882708297	0.114006021157
0.41170305654	−0.333956372282	−0.329256170778
0.513009463063	0.0844550928134	0.573333912191
0.93104586541	0.14978237177	−0.332744402822

K11n94

0.0	0.0	0.0
1.0	0.0	0.0
0.0164283008511	0.180517901144	0.0
0.838479141924	−0.195809944599	−0.427328640755
0.528391259642	0.264719416123	0.404391392173
0.598279420651	−0.0441034336185	−0.544157021155
0.347954981457	−0.341548469326	0.377181204403
0.486403230713	0.449220704198	−0.219070585097
0.253209640125	−0.493470754237	0.0195788722728
0.916280879456	0.143233929388	−0.374049985182

K11n100

0.0	0.0	0.0
1.0	0.0	0.0
0.0842505333597	0.401749815617	0.0
0.71461053218	−0.0773261469546	−0.610845720271
0.749328466208	0.0706953121019	0.377528860905
0.519314780513	0.0921845730079	−0.595421248843
0.139434638065	−0.277808201186	0.252397378234
0.381727519569	−0.0122606538618	−0.680757839124
0.774014451855	0.233698672785	0.205591399265
0.585263446196	−0.740317822892	0.33075099343

K11n101

0.0	0.0	0.0
1.0	0.0	0.0
0.0873303869392	0.408698149489	0.0
0.266965206372	−0.571477677406	0.083586362637
−0.0317651701339	0.374948474105	−0.0390419452276
0.939253643207	0.196261429924	0.119682357823
0.475713867352	−0.518541781664	−0.403946561264
−0.0294437221852	−0.0254415859237	0.304338696732
0.872943546226	−0.0500718685715	−0.125882835721
0.557351867354	0.661003546317	0.502427315851

K11n107

0.0	0.0	0.0
1.0	0.0	0.0
0.155773983975	0.535987344875	0.0
0.913302973949	−0.0758480443663	−0.227612139001
0.643464499649	0.312281574198	0.65360440475
0.451532678961	0.335615877362	−0.32752641553
0.887399599366	−0.0813780389626	0.47005499188
0.521747645655	0.735519854371	0.0239871936541
0.566027240341	−0.253950246463	−0.113810618556
0.655125894832	0.385797515552	0.649592440624

K11n102

0.0	0.0	0.0
1.0	0.0	0.0
0.219888945991	0.625641065958	0.0
0.845304217261	−0.150091860597	0.0842268669792
0.504582974707	0.766434774312	−0.125267673226
0.626568349368	−0.172916216957	0.195262018957
0.399512190157	0.717590025602	−0.199002020144
0.599361358903	0.0741029125012	0.539905717686
−0.238426062031	0.394170642924	0.097560959306
0.691976308059	0.718126223315	−0.0739156037141

K11n110

0.0	0.0	0.0
1.0	0.0	0.0
0.204692232527	0.606205868494	0.0
0.698218985133	−0.260180524391	0.0761968679499
−0.000438262987122	0.365230478279	−0.271278494326
0.693116747763	0.16060325094	0.419452383002
0.433026873322	0.60104378802	−0.439829520979
−0.206012333233	−0.166866202668	−0.48391056776
0.31472490044	0.140562778998	0.312531617649
0.542355675368	0.673227930299	−0.502607675292

K11n104

0.0	0.0	0.0
1.0	0.0	0.0
0.0988596636664	0.433527501126	0.0
0.703810176617	−0.260851077583	−0.389709207373
0.594821293559	0.447249535172	0.307940379158
0.200753569114	0.0495728120698	−0.520651107917
−0.153332987703	−0.322693624485	0.337276867205
0.348733745592	0.279302128453	−0.283633841966
0.797616235658	−0.324466961136	0.375128176193
0.854597049356	0.457659263473	−0.245381095012

K11n111

0.0	0.0	0.0
1.0	0.0	0.0
0.175841258706	0.566358869577	0.0
0.655636840517	−0.258890549539	−0.2979254872
0.562310691173	0.652602161859	0.102663163309
0.135318141481	−0.0964905399944	−0.403832134336
0.796429084582	−0.226711641622	0.335068931844
0.296596297429	0.285716728813	−0.363203472065
0.798541748303	0.297481874305	0.501615784022
0.708942430013	0.528276076784	−0.4672526272

K11n106

0.0	0.0	0.0
1.0	0.0	0.0
0.116833863586	0.469060311145	0.0
0.834632619186	−0.0268252946236	−0.488735524032
0.224051862999	0.113692581534	0.290652612043
−0.201779905596	−0.153977391563	−0.573650627773
0.226339309214	0.0423507953511	0.308488352736
0.378037464381	0.680523271131	−0.446311992306
0.169818109679	−0.0863101064335	0.160821659685
0.686960887554	0.710912580353	−0.15062550271

K11n112

0.0	0.0	0.0
1.0	0.0	0.0
0.289688324757	0.703887294966	0.0
0.17734256011	−0.248589245129	−0.283137545611
0.719793767326	0.588533756513	−0.212626781097
0.26821754059	0.268092355562	0.620077380058
0.451337267341	0.136113239624	−0.354113914623
0.307470184915	0.228254184854	0.631184166572
0.0638928478618	0.589985993099	−0.268715927759
0.768324448438	0.472896244318	0.431331292677

K11n113

0.0	0.0	0.0
1.0	0.0	0.0
0.156880737321	0.537726611671	0.0
0.634736036579	-0.338161623224	0.0668888102993
-0.0121197463447	0.386289459892	0.305107668222
0.93883610846	0.350315314373	-0.00211997224568
-0.0461017314102	0.282936666884	-0.161360574652
0.636810071011	-0.333367032726	0.230814411752
0.130783748868	0.339295832172	-0.309057824509
0.513625637056	0.648927367943	0.561321633374

K11n120

0.0	0.0	0.0
1.0	0.0	0.0
0.277536461717	0.691409022108	0.0
0.412693244706	-0.299338859675	-0.0122995428887
0.337658909171	0.688144595772	0.126431397101
0.186129673527	-0.204702925378	-0.297670235438
0.383542650906	0.714277640105	0.0436548832217
0.109646743989	-0.215505894163	0.289589044287
-0.014165783603	0.491319295179	-0.40687962674
0.622602118682	0.708118078217	0.333069646043

K11n114

0.0	0.0	0.0
1.0	0.0	0.0
0.190750634398	0.587465287718	0.0
0.362093594354	-0.38838181934	-0.135513887555
0.201049110474	0.525259599836	0.237747457051
0.523710890446	0.219016038872	-0.657855276929
-0.039169884436	-0.0303554554885	0.130166988662
0.485831958729	0.794762281032	-0.0785284486461
0.0622965356238	-0.0516330597504	0.244322403107
0.647919352701	0.750705560597	0.12900261115

K11n121

0.0	0.0	0.0
1.0	0.0	0.0
0.33604238126	0.74777020569	0.0
0.349500034445	-0.17793128316	-0.378015403275
0.2161995482	0.366617383458	0.450053271445
0.282630349708	0.563598206916	-0.528100859457
0.622536545377	0.420597254867	0.40142294651
0.449671485021	-0.324722251239	-0.242484270973
0.108708180007	0.601029519798	-0.405970304188
0.940645200656	0.330228531115	0.0783308605864

K11n116

0.0	0.0	0.0
1.0	0.0	0.0
0.480453631213	0.854442257078	0.0
0.534984745912	-0.143563213338	-0.031803121713
-0.295755112437	0.372267454401	0.177457505187
0.239250353895	-0.472516022795	0.166968098546
0.606573746241	0.407713583005	-0.133480510219
0.231820020543	0.092373437636	0.738368236866
0.460257082203	-0.0337811482342	-0.226982232821
0.648691478985	0.336422802823	0.682655889034

K11n122

0.0	0.0	0.0
1.0	0.0	0.0
0.0407117517868	0.282428852705	0.0
0.795780893882	-0.360634503249	-0.127828443175
0.379617255928	0.436643452098	0.309385106893
-0.0128885519767	-0.482942607952	0.292045299418
0.204100503479	0.386265999297	-0.152243060656
0.91323354104	-0.261457722529	0.12629655093
0.0996526119336	0.197708389511	-0.2304282076
0.884973448917	0.261349299026	0.385381030425

K11n118

0.0	0.0	0.0
1.0	0.0	0.0
0.334488568012	0.746387656579	0.0
0.717669932529	-0.155271124548	-0.200458185921
0.605742766488	0.572237934536	0.476448660293
0.459803751979	0.410228329378	-0.499489192175
0.58962551994	-0.288132993686	0.204384213354
0.557535022259	0.669852734256	-0.0806307775143
0.1586726053	-0.247118776444	-0.072144264529
0.916897540188	0.345224787361	0.200296647471

K11n124

0.0	0.0	0.0
1.0	0.0	0.0
0.0276200609408	0.233403629182	0.0
0.656000584023	-0.510304815933	-0.228113276413
0.186973374792	0.243649397233	0.231850332419
0.834950289497	-0.114447376827	-0.440379255161
-0.0183201564193	0.0187447332006	0.0637927471882
0.792073671985	0.548575060661	-0.186290572902
0.0910523473191	-0.0219228745154	0.241612696918
0.961375266857	0.181561186012	-0.206865009148

K11n125

0.0	0.0	0.0
1.0	0.0	0.0
0.133170728226	0.498605067759	0.0
0.825428609959	−0.22271476488	−0.0218340152023
0.279751248558	0.579043288003	0.221928660146
0.43763807592	−0.166628022929	−0.425408999657
0.604206315508	−0.233238721873	0.558368432666
0.693370868953	0.286249625378	−0.291444216969
0.10027272102	0.583657926728	0.456742183072
0.904634616732	0.411253465154	−0.111833794573

K11n132

0.0	0.0	0.0
1.0	0.0	0.0
0.0116882237048	0.152446163731	0.0
0.523484839531	−0.575496351743	−0.456249841858
0.309043688572	0.214234604539	0.11850228686
0.116541074022	−0.331336407124	−0.69715389967
0.482225533569	−0.102954722223	0.205130247397
0.572425900027	0.426390682947	−0.638467604613
0.134549642306	−0.126827951321	0.0702026470713
0.779799050707	0.618107600848	−0.0992795763958

K11n128

0.0	0.0	0.0
1.0	0.0	0.0
0.0790393998708	0.389655710865	0.0
0.847021888161	−0.22990752816	−0.162309243509
0.0576463903457	0.187432878466	0.287927703493
0.546811236129	0.186114508703	−0.584262651619
0.925826608432	0.0313986970315	0.328102607022
0.0858654879059	0.0299085572014	−0.214541931776
0.846872607995	−0.225822015344	0.381671148791
0.750592701884	0.655878811115	−0.0802096067069

K11n133

0.0	0.0	0.0
1.0	0.0	0.0
0.116487279316	0.468407165177	0.0
0.628312380557	−0.390583119838	−0.0130673635374
0.641488318326	0.561820281954	0.291488304479
0.290435558794	−0.209938651476	−0.238747594624
0.47310068791	−0.0357330465978	0.728871058479
0.593011802439	0.327122951625	−0.195226798442
0.576400073679	−0.265880025823	0.609802094956
0.966820670649	0.108245590562	−0.231388597233

K11n130

0.0	0.0	0.0
1.0	0.0	0.0
0.0340593654915	0.25876377375	0.0
0.824048436805	−0.131423814307	0.472938593616
0.601662162769	0.688845254466	−0.0540367378122
0.101382830952	−0.174737815406	0.00877147493185
0.647201499959	0.63504898713	0.224009285278
−0.0487002207055	0.143884789585	0.747916267696
0.128302015724	−0.039443943811	−0.219069142644
0.892259252136	0.325059865812	0.31338396675

K11n134

0.0	0.0	0.0
1.0	0.0	0.0
0.41592347184	0.811698595079	0.0
0.23959555609	0.0671905915517	0.643907057588
−0.0100060453675	0.46300339185	−0.239852676542
0.648750659383	−0.181251226297	0.148703099304
−0.277120523565	0.14929921452	−0.034324108134
0.190868296192	0.465077855162	0.791066899023
0.189285450901	−0.0417750231728	−0.0709642224125
0.482228641307	0.614687453807	0.624191374207

K11n131

0.0	0.0	0.0
1.0	0.0	0.0
0.0760850586483	0.382597936674	0.0
0.864258218308	−0.226344113922	0.0892896937428
0.168131896863	−0.282017762776	−0.626467659985
0.480344329534	0.173719573551	0.207095101397
0.625929866564	−0.397244928587	−0.600868009584
0.676797108308	0.328058121205	0.0856798836328
0.652997885407	−0.633524728583	−0.187801413686
0.956390085606	0.280330844212	0.0820525559532

K11n135

0.0	0.0	0.0
1.0	0.0	0.0
0.0372673157102	0.270454762576	0.0
0.671828190209	−0.474189458003	−0.206972175215
−0.073780100404	−0.145486952794	0.372702681957
0.440199799513	0.119579922701	−0.443118508008
0.418054771453	0.109316767128	0.556583580301
0.291926227094	0.786969840414	−0.167900996873
0.0960783089122	−0.168540525882	0.0526517923732
0.896016755114	0.427919232505	0.118486729247

K11n138

0.0	0.0	0.0
1.0	0.0	0.0
0.181405934495	0.574372488826	0.0
0.801335294399	-0.210081299173	0.0178841612291
0.344431366941	0.515077148082	-0.497270211215
-0.00170128103694	-0.371875922486	-0.19148198284
0.656684827146	0.31886434821	0.107525727747
0.632331692625	-0.59716077939	-0.292855203925
0.630133987654	0.261048816827	0.220439505823
0.680109915123	-0.0393908346954	-0.732051135846

K11n139

0.0	0.0	0.0
1.0	0.0	0.0
0.0148803055145	0.171869681843	0.0
0.538207943801	-0.678109498115	-0.0605274866832
0.28931147102	0.152021630491	-0.559459200605
0.507330479745	0.0263225782568	0.408356618702
-0.0656578273976	-0.141525175984	-0.393835086113
0.583621785691	-0.683413915449	0.139824522691
0.300151800522	0.275563594165	0.142451985797
0.850507305262	-0.437096138386	-0.292547926851

K11n141

0.0	0.0	0.0
1.0	0.0	0.0
0.103400064823	0.442841457229	0.0
0.969452977988	-0.0565908576785	-0.0227972460064
0.183885261877	0.471069809789	0.300401738232
0.728752352818	-0.181188775337	-0.226550433543
0.161169026666	-0.287790867333	0.589834991276
0.313862550799	0.298534119516	-0.205719970675
0.258744445582	0.448657512375	0.781409687168
0.859384196977	0.511090297534	-0.0156687508677

K11n143

0.0	0.0	0.0
1.0	0.0	0.0
0.0643977195902	0.353055764564	0.0
0.780719617818	-0.299483775035	-0.24713374391
0.34310505378	0.421998145987	0.289482814706
0.544468632141	-0.553081608945	0.382607359443
0.364768876163	0.06799695997	-0.380261835725
0.364671870363	0.305060261915	0.5912323647
0.485797681048	0.0408016493361	-0.365583147122
0.675108252857	0.581359170735	0.454147951142

K11n145

0.0	0.0	0.0
1.0	0.0	0.0
0.165535166613	0.551061196093	0.0
0.0970658518067	-0.44600131255	0.0343264735784
0.609524130376	0.324212006648	-0.345354913449
0.132621730568	-0.125487029809	0.409850275666
0.328204247649	0.0393694718419	-0.556881234566
0.0855993388603	0.294172448191	0.379184095139
0.250325234165	-0.484895712108	-0.225727618274
0.854483295129	-0.150004699632	0.497349865219

K11n146

0.0	0.0	0.0
1.0	0.0	0.0
0.0266870734218	0.229481909866	0.0
0.830037662034	-0.243128496216	0.362308205591
0.501939007134	0.325439803327	-0.392066609343
0.282563691648	-0.179286821967	0.442873810492
0.627567382545	-0.122759542067	-0.494023793248
0.287548543021	0.426283913509	0.269480281828
0.193183193727	-0.383828224762	-0.309150433118
0.979708121965	0.186727241358	-0.0728349716235

K11n147

0.0	0.0	0.0
1.0	0.0	0.0
0.188259409015	0.584018161487	0.0
0.520706831573	-0.350734633008	0.125363170104
0.0615104415276	0.276199836843	-0.503995110912
-0.0113718356628	0.0851481213489	0.47487536861
0.140741822306	0.098427902408	-0.513398420618
0.583707291278	0.283578952168	0.363813459187
-0.0985521358791	0.121005768019	-0.34899228844
0.364908189232	0.930985823728	0.0103638530155

K11n149

0.0	0.0	0.0
1.0	0.0	0.0
0.105870320168	0.447808123691	0.0
0.0036853310705	-0.494994204955	-0.317304265812
0.396046780288	0.335325617756	0.0784500584617
0.0357841755641	0.213186945268	-0.84637046484
-0.0962962321894	0.215970420684	0.144864632476
0.884696579083	0.227299180666	-0.0488484631787
-0.112047999153	0.212090897805	0.030328262501
0.788956593738	0.582557580074	-0.195382084886

K11n156

0.0	0.0	0.0
1.0	0.0	0.0
0.197529897879	0.596692328761	0.0
0.247584062823	−0.393191498246	−0.132757634815
0.771918775096	0.427317742899	0.0949212941651
0.570135118551	−0.279649067098	−0.582929194892
0.0435954103225	−0.127746726229	0.253540538271
0.616170118297	0.503986632787	−0.269021579468
0.815896694691	−0.221845987006	0.389215689856
0.796314100484	0.55534200158	−0.239748023249

K11n157

0.0	0.0	0.0
1.0	0.0	0.0
0.179023504602	0.570961989981	0.0
0.600712066061	−0.335576027378	0.0191723815847
0.562126367687	0.539243741903	−0.463737045902
0.200241767832	0.135725270986	0.376627386958
0.526936403188	0.689036151728	−0.389608663148
0.316939579836	−0.00345775517027	0.300575024787
0.306692505524	0.383828428474	−0.621327578218
0.677204819554	0.689974029584	0.255596304496

K11n159

0.0	0.0	0.0
1.0	0.0	0.0
0.111913767583	0.459676890643	0.0
0.715520143795	−0.330564556024	0.105725108491
0.668501106072	0.653168540849	−0.0676484887138
0.114661307227	−0.0738322537768	0.338222576809
0.911705898577	0.237142087781	−0.179478957177
0.446266091993	−0.408262027468	0.4261771453
0.870261974721	0.187482179566	−0.255963845416
0.664581040539	0.190016203592	0.722651979122

K11n160

0.0	0.0	0.0
1.0	0.0	0.0
0.0906737886992	0.416083935572	0.0
0.724115636816	−0.263602167665	0.369835404093
0.371116292845	0.317416280371	−0.363519234672
0.702336643296	0.211903624359	0.574116173613
0.677364822672	−0.626114909583	0.0290461368799
0.822029164597	0.339154148288	−0.188503567997
0.319075616476	−0.35792185942	0.322498161853
0.834271810946	0.495368821649	0.242074938809

K11n164

0.0	0.0	0.0
1.0	0.0	0.0
0.205736264302	0.607573138112	0.0
0.708744651699	−0.22967590057	−0.214468201451
0.0862518403552	0.499691342705	0.0693030519593
0.635967984683	−0.332891833928	0.137254613039
0.492381095473	0.359887359004	−0.569455932437
0.543953258083	−0.158443751345	0.284167621648
0.138105969774	0.272346937378	−0.521876645797
0.996510237317	0.00640215026006	−0.0832247523002

K11n165

0.0	0.0	0.0
1.0	0.0	0.0
0.00287041061044	0.0757138162015	0.0
0.960365381528	0.125262674741	0.284162438204
0.234441728949	−0.115996554515	−0.359909634569
−0.103841243533	0.184807468829	0.531763831487
0.0774029068641	0.663117885477	−0.327520582006
0.452323430688	−0.183657839337	0.049845914497
−0.169074127131	0.598061186885	−0.00288395541499
0.816783052907	0.554610699574	0.158973005262

K11n166

0.0	0.0	0.0
1.0	0.0	0.0
0.0168612532354	0.182861162115	0.0
0.661095153029	−0.0734957451136	0.720585746787
0.938970474517	0.0480498889519	−0.232310871188
0.0351833930375	−0.148135470647	0.148057655415
0.862799826171	0.339893809529	−0.129211999071
0.253245517526	−0.445286001288	−0.238464960117
0.480769473464	0.444773333887	0.156537861824
0.889234976385	−0.346187980416	−0.299023475648

K11n172

0.0	0.0	0.0
1.0	0.0	0.0
0.0375753820209	0.271548991358	0.0
0.764763761034	−0.294557606497	0.388227228943
0.442387440339	0.65205343951	0.387209666369
0.202295046818	−0.124740791299	−0.194981337989
0.734332455053	0.149974386722	0.605935491154
0.0732095284809	0.0779350444434	−0.140875602179
0.530534743759	−0.404422093435	0.606242353039
0.743086021061	0.547352838111	0.385003942728

K11n173

0.0	0.0	0.0
1.0	0.0	0.0
0.302592264936	0.716674578225	0.0
0.53573155124	−0.216777389013	−0.272605022043
0.572117814096	0.349070173	0.551101586186
0.49981674991	−0.0855172948506	−0.34662124905
0.302859848806	0.0931864638022	0.617366793277
0.424374920043	0.640700106546	−0.21056007455
0.265715645814	−0.294281446495	0.106672852766
0.788727127523	0.535297702552	0.302267907578

K11n184

0.0	0.0	0.0
1.0	0.0	0.0
0.143970920366	0.516927668848	0.0
0.806238184285	−0.21478663822	0.161233507601
0.559780944625	0.601039875502	−0.36191649816
0.229867161615	−0.0729290275232	0.29908487365
0.843714443142	0.0492026076866	−0.480835236773
0.509609146959	0.631908125081	0.259993981779
0.473475515451	−0.277615963061	−0.154083660412
0.744908654669	0.666304636754	0.0339002542672

K11n174

0.0	0.0	0.0
1.0	0.0	0.0
0.413914713422	0.810249367082	0.0
0.984024134244	0.0093649489048	−0.183192240586
0.11413402834	0.0197573082081	0.309943848661
0.748295582538	−0.0142016982954	−0.462510621877
0.0921396375546	−0.170453072941	0.275760929643
0.604772789174	0.615696140789	−0.0694588056142
0.175964957416	−0.278410135689	−0.198678810975
0.946596099827	0.32208642378	0.0147023606693

K12n121

0.0	0.0	0.0
1.0	0.0	0.0
0.0938602599631	0.422978452791	0.0
0.496664494042	−0.47938736078	−0.153247145177
0.281790940713	0.458796831123	0.118119356334
0.294280306824	−0.504190508868	0.387376480198
0.272929665987	0.180893128547	−0.34077498748
0.582279778485	−0.216259815164	0.523269020195
−0.000420207510677	0.0502444970384	−0.24447844994
0.880026183706	−0.423036533014	−0.215856451667

K11n176

0.0	0.0	0.0
1.0	0.0	0.0
0.0609814085662	0.343866376579	0.0
0.42215147935	−0.350371738617	−0.622566959755
0.82500777883	0.48105243845	−0.239891327193
0.238913241008	−0.231529264864	0.145751653861
0.689808352337	0.147763162949	−0.662227833987
0.553727687379	0.310510901406	0.315010737832
0.168717124494	−0.166739318122	−0.4749253953
0.899333766158	0.419197642541	−0.124386950829

K12n274

0.0	0.0	0.0
1.0	0.0	0.0
0.381922172665	0.786116912015	0.0
0.261883550454	0.108608889112	−0.725653917566
0.358026124915	−0.0857643695402	0.250550795441
0.18150872052	0.366630639648	−0.623623307131
0.836555458646	0.440809744624	0.128315008993
0.388391125864	−0.33876374722	−0.309193735648
−0.0867390305919	0.389127708742	0.185200199149
0.784451227305	0.55494649878	−0.276894664939

K11n177

0.0	0.0	0.0
1.0	0.0	0.0
0.14871141944	0.524697772635	0.0
0.864624728936	−0.0646146701311	0.374404831816
0.761696379845	0.294763250398	−0.553093559121
0.394691320419	0.353637668897	0.375260408503
0.717388331638	−0.375025552636	−0.228822821306
0.412138539943	0.480438802998	0.189511137284
0.873434714825	−0.35471934077	−0.110016347159
0.703821937559	0.587249933123	−0.399715143894

K12n358

0.0	0.0	0.0
1.0	0.0	0.0
0.139309198079	0.50912802269	0.0
0.208300197013	−0.467897930612	0.201644560157
0.28898366545	−0.0697767547002	−0.712133151987
0.583083067607	0.228945116608	0.195760445993
0.279718316307	−0.598406413649	−0.276954344393
0.123413189941	0.304160809851	0.124220323969
0.765607541541	−0.174095204343	−0.474826919294
0.755289714484	0.648698976096	0.0934188717866

K12n371

0.0	0.0	0.0
1.0	0.0	0.0
0.2007743553	0.601031088093	0.0
0.104400270853	−0.393564004198	0.0386346766141
0.59179564791	0.454949120292	−0.167450800775
0.196834871361	−0.223722855143	0.45175056772
0.412598682944	0.0193119181753	−0.493966132233
0.0384484718116	0.254454168851	0.403095594437
0.347080070775	−0.295835790494	−0.372744270977
0.940799679441	0.283702629018	0.185496041609

K12n484

0.0	0.0	0.0
1.0	0.0	0.0
0.191034447716	0.587856049742	0.0
0.707298779977	−0.194055303482	0.349407748818
0.439353278263	0.23075195709	−0.515314171498
0.764973411476	0.423262710666	0.410380777501
0.535807563555	0.0133869301478	−0.472503619626
0.512213978463	0.130370021479	0.520349994501
0.295315830937	−0.046370551874	−0.439711442768
0.856118292741	0.475063336632	0.203411639349

K12n407

0.0	0.0	0.0
1.0	0.0	0.0
0.0432924209375	0.291050868689	0.0
0.406489664552	−0.622509380055	−0.18301757879
0.694939580874	0.287052219178	0.116138472419
0.0757255115937	−0.40074015621	−0.262696035993
0.78829750326	−0.00423959912828	0.316120398575
0.669675361738	0.0336901519357	−0.676094357173
0.310305995745	−0.317348408445	0.18855909243
0.886504623907	0.282834952591	−0.366215703357

K12n488

0.0	0.0	0.0
1.0	0.0	0.0
0.0678756728807	0.362138424905	0.0
0.873468709044	−0.178635480154	−0.242040169585
0.34825056204	0.457874679046	0.322761313498
0.791701183441	0.0964701525661	−0.497444949962
0.397010584506	0.0723212045139	0.421051734529
0.543355157305	0.673226694811	−0.364757312087
0.414570198893	−0.213484515961	0.0792670827127
0.672522260623	0.722554887134	−0.16008823831

K12n443

0.0	0.0	0.0
1.0	0.0	0.0
0.0418196263583	0.286164937698	0.0
0.693442769302	−0.44893309808	0.187131390672
0.511219901045	0.46500120102	−0.175523987356
0.761362453821	−0.152939341314	0.569847188254
0.471525125686	−0.216971115883	−0.385084356447
0.661378257911	0.493190566118	0.292872997376
0.201798833209	−0.324141853802	−0.0546244382093
0.933977822274	0.356374192005	−0.0261316431394

K12n603

0.0	0.0	0.0
1.0	0.0	0.0
0.0908629502855	0.416497088629	0.0
0.409452971627	−0.523659523361	0.120855050505
0.884982357323	0.291347505028	−0.210257237119
0.0127738844894	−0.0178362736313	0.168764887475
0.845385142926	0.0232890314636	−0.383564001508
0.457195954774	0.211222508048	0.518650032178
0.606637132151	0.400795528732	−0.451777401653
0.904776942415	−0.425036573987	0.0268811318065

K12n475

0.0	0.0	0.0
1.0	0.0	0.0
0.0299183238983	0.242778791684	0.0
0.890329858387	0.0452735204124	0.46976979377
0.317880949147	0.090851077841	−0.348902871322
0.443537658579	0.740490632226	0.400882991943
0.630723482822	−0.14137760996	−0.0318638978499
0.455817923494	0.83313035773	0.108643277142
0.386958767537	−0.0648532205925	0.543251042493
0.926374763039	0.313181174174	−0.209158673134

K12n609

0.0	0.0	0.0
1.0	0.0	0.0
0.104766393165	0.445597115333	0.0
0.532797263252	−0.315045335154	−0.488070319493
0.907901264397	0.193256726511	0.2871238513
0.48639773078	0.27575634228	−0.615942361414
0.455249944994	−0.113014059445	0.30486564799
0.512704690539	0.130814270157	−0.663249375082
0.25340275113	0.380494633952	0.269714836533
0.753628503385	0.28736261268	−0.591157176832

K12n662

0.0	0.0	0.0
1.0	0.0	0.0
0.11398327561	0.463653280049	0.0
0.549703323713	-0.0062414698182	-0.767689366689
0.803602098313	0.389262678911	0.114983778136
0.0397546679553	-0.240757220134	-0.0250591793597
0.67358784197	0.531574307733	0.0168874364953
-0.0803094974927	-0.0260690703076	-0.330492275748
0.589789412785	-0.0927176368825	0.408781299472
0.830800683409	0.233000173907	-0.505451425367

K13n1644

0.0	0.0	0.0
1.0	0.0	0.0
0.149016078366	0.525191741291	0.0
0.685631105514	-0.318629320109	0.00321387238193
0.292591656067	0.600760189539	-0.0123720419697
0.30394975143	-0.165440376055	0.63012907628
0.629756399169	0.0228702225772	-0.296363852312
0.362438127116	0.154398197034	0.658225762843
0.20002136472	0.460840088836	-0.279705024711
0.994718846945	-0.0111032262845	0.102034964102

K12n730

0.0	0.0	0.0
1.0	0.0	0.0
0.0785151930709	0.388414405756	0.0
0.720487846078	-0.149720893756	0.546151546926
0.135436423786	0.608832524189	0.259251659513
0.31689786725	-0.265309059681	-0.191246105061
0.254983199539	0.494707728989	0.455701384973
0.0569210595628	0.313179385852	-0.507532153347
0.137991676894	-0.0329027366078	0.427162834079
0.500045927699	0.854375296824	0.141410474748

K13n2303

0.0	0.0	0.0
1.0	0.0	0.0
0.187512717649	0.582978915585	0.0
0.507099864403	-0.347372241058	0.179751998489
0.783839073585	0.535657710336	-0.199290894917
0.0635378905507	0.130559160278	0.363791133264
0.88950020296	-0.0811483293217	-0.158670537414
0.604963672928	0.445522276548	0.642364440593
0.127289789117	-0.0969364180101	-0.0486972248341
0.703029035866	0.687495748354	0.181933423881

K12n812

0.0	0.0	0.0
1.0	0.0	0.0
0.408055203821	0.805978509811	0.0
-0.0713759571749	-0.0528893841154	0.18025454959
0.542128773039	0.623429196138	-0.227428076982
-0.015327732797	0.0042434500225	-0.780466281728
-0.00501265244019	0.159284118894	0.207387953528
0.234466927103	-0.539054842768	-0.46712833657
0.171403391841	0.258538011748	0.132762177562
-0.756560524249	0.627815914394	0.182929906742

K13n2436

0.0	0.0	0.0
1.0	0.0	0.0
0.101078543994	0.438109821771	0.0
0.901529832971	-0.113750117612	0.233940892705
0.566149823158	0.497175391093	-0.483199450485
0.395286573815	0.349631069469	0.490985554111
0.978614838608	-0.204224037885	-0.103129464678
0.394049655267	0.606186399438	-0.0641619204633
0.72645008696	-0.302469325038	0.188533009021
0.766017238057	0.549872433049	-0.332953297583

K13n469

0.0	0.0	0.0
1.0	0.0	0.0
0.0422568226448	0.28762476637	0.0
0.663173615657	-0.496243830537	0.00351552829956
0.451740048632	0.37824379033	0.440055615446
0.406550395848	-0.289785107311	-0.302706316263
0.184598638168	0.0325514000808	0.617530932094
0.727445463066	0.0791124902055	-0.22100910248
-0.0124790709677	-0.236204361427	0.373202111661
0.958271997623	-0.252674835586	0.13367948995

K13n2491

0.0	0.0	0.0
1.0	0.0	0.0
0.0449796968468	0.296540419783	0.0
0.343014268311	-0.612958328266	-0.289805834153
0.341041222154	0.316010851878	0.0803459852819
-0.212774642268	-0.0560217842539	-0.664556495562
0.430563465984	-0.177264550046	0.0913643139236
0.33234425866	0.749405071534	-0.271452995136
0.131605780488	-0.161733117369	0.08845152568
0.858796470876	0.509158402619	-0.0568009036377

K13n2868

0.0	0.0	0.0
1.0	0.0	0.0
0.351911056179	0.76156465313	0.0
0.238925759794	-0.217519006908	-0.16920256927
0.504566888102	0.418072100088	0.555682756598
0.156598053072	-0.198453401305	-0.150584895202
0.693227638977	0.592373024198	0.143731689883
0.265250482572	-0.308957425835	0.210357311361
0.234635908432	0.587770331175	-0.231165142946
0.880898164487	0.202731019103	0.427689791434

K13n2872

0.0	0.0	0.0
1.0	0.0	0.0
0.203276551315	0.604344062861	0.0
0.34673838571	-0.384558565446	-0.0386043235979
-0.132936926037	0.492728047786	-0.0218772932237
0.0558493388559	-0.415533185318	-0.395268882081
0.471755181615	0.216134298219	0.258962361594
0.393160318727	0.240518850117	-0.737646007403
0.236527889769	-0.109590791205	0.185874171722
0.783409669666	0.331563552752	-0.525675660422

K13n3958

0.0	0.0	0.0
1.0	0.0	0.0
0.0787953490878	0.389078386881	0.0
0.806479093551	-0.213970781319	0.326815037563
0.252753050353	0.461067648476	-0.160740689903
0.543096627027	0.125023190077	0.735236279368
0.672976963351	-0.0216249250407	-0.245388739979
0.349387791307	0.839206992544	0.147368764599
0.221550205794	-0.133474264143	-0.046406168297
0.628943206398	0.777093903587	0.0235692200576

K13n4024

0.0	0.0	0.0
1.0	0.0	0.0
0.103202283624	0.442440793669	0.0
0.609821761947	-0.0723217862344	-0.691632988308
0.488713700591	0.322994478746	0.218893171732
0.69869800208	-0.270505596096	-0.558065163245
0.451043076198	-0.189360246599	0.407379019471
0.564370163571	0.586990144488	-0.212650852008
0.245129253274	-0.285112247901	0.158189623644
0.889446281557	0.456027272078	-0.0304045941621

K13n4075

0.0	0.0	0.0
1.0	0.0	0.0
0.160266277582	0.542998412	0.0
0.431826486825	-0.413825696019	0.103646896094
0.510590416337	0.534869865761	-0.202576836603
0.618805054014	-0.191149564394	0.476529472622
0.139748099752	-0.0428114660139	-0.388629612832
0.506124741605	0.223583578191	0.502886980804
0.346772931992	-0.211274194098	-0.383400624126
0.924956336273	0.227362075596	0.304568978344

C.3 11-Stick Knots

10_7

0.0	0.0	0.0
1.0	0.0	0.0
0.0871863601103	0.40837636909	0.0
0.767734103756	−0.306759684281	0.159484149017
0.0729351502947	−0.310892260928	−0.559707992264
0.463045445109	0.0758401367107	0.275906757784
0.331297242663	0.0642520951573	−0.715308722546
0.677600987869	0.320244432269	0.187210883554
0.558630634981	−0.518491807013	−0.344171818505
0.392464189803	0.0536451400049	0.458977001051
0.868267871647	−0.398526800083	−0.295444229391

10_{15}

0.0	0.0	0.0
1.0	0.0	0.0
0.305293714933	0.719293526655	0.0
0.420522101032	−0.136093097109	−0.505011032476
−0.273650500885	0.328720088588	0.0446007406424
0.455237122966	−0.347204810793	−0.0642494416869
−0.20065322866	0.0493877444953	−0.706528346629
0.411577484638	0.532846444273	−0.0808756959485
−0.0851481181243	−0.14982372842	−0.616809563954
0.524595831117	−0.0490914627526	0.169361744997
0.567415262316	0.304716012002	−0.76497586375

10_8

0.0	0.0	0.0
1.0	0.0	0.0
0.0602998170483	0.341999365731	0.0
0.719994150511	−0.388117428516	−0.178137175105
−0.205996914608	−0.0842514270231	0.0459297801919
0.757908166519	0.138353773398	−0.100131574463
0.373801666493	−0.394484362809	0.653888131673
0.700312929733	−0.166978772306	−0.263516686968
0.452404849743	0.610929052517	0.31389218026
0.206602340281	−0.13097577687	−0.309933396703
0.931141680159	0.0111499867148	0.36448710439

10_{16}

0.0	0.0	0.0
1.0	0.0	0.0
0.124754799696	0.483679479971	0.0
0.0389643071611	−0.266054315576	0.656154880501
0.820364947018	0.102929383115	0.152901395534
−0.154611197443	−0.0864566903563	0.269324902213
0.301024198071	0.801363092874	0.333919165576
0.310359023884	−0.10503099586	−0.0884108202588
−0.340128986413	0.315068563128	0.544346407277
0.313723770647	−0.223757147417	0.0131746594007
0.0898178220981	−0.148279326533	0.984858365531

10_{10}

0.0	0.0	0.0
1.0	0.0	0.0
0.236713421703	0.646060058657	0.0
0.0830670463232	0.0658883782881	−0.799870997493
0.336900556633	−0.0451687922233	0.16098011164
−0.0425839061805	0.314217920204	−0.691564745487
0.664727599604	0.406271213498	0.00931800146694
−0.181389636369	−0.126488366052	0.0252193657728
0.623612904546	−0.651797537767	−0.250500026422
0.441792759643	0.278664764841	0.0675901154129
0.139532019856	0.485809336725	−0.862855783886

10_{18}

0.0	0.0	0.0
1.0	0.0	0.0
0.0642163352076	0.352574719326	0.0
0.617260761633	−0.467425875634	0.147447911705
0.283979732278	0.43327329743	−0.13123605826
−0.215057650513	−0.170955462113	0.489947728327
0.240667313241	−0.0645307314848	−0.393787828342
0.23537955584	0.245029648546	0.557077257112
0.245061003237	0.34643792599	−0.437720526783
0.586740121483	−0.208622114542	0.320674971332
0.410078358519	−0.771133668838	−0.487020127571

$\mathbf{10_{20}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.153219825859	0.531942982547	0.0
0.00853508706021	−0.404403502899	−0.31987745396
0.210642827625	0.525004170887	−0.011083287707
0.615746552276	−0.208370891073	0.534858092635
0.627026972699	0.312587105244	−0.318649680141
0.455379230799	0.37661054892	0.664426131463
0.169400011945	0.38788360248	−0.2937433758
−0.000931253153208	0.258966804641	0.683174082006
0.85836499024	0.465666964496	0.215322599155

$\mathbf{10_{21}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.0957469870389	0.426997059183	0.0
0.147582426301	−0.571234405637	−0.0291037777652
0.699700728084	0.230267730142	−0.258798590893
−0.00722549886448	−0.452498956658	−0.443419719284
0.296011792746	0.254222169946	0.195792603961
0.0898398486825	−0.601312597204	−0.279132012877
0.873808260875	−0.257329694339	0.237655459127
−0.0400218096766	−0.151853731458	−0.15450448708
0.950495281486	−0.117706465493	−0.287582871279

$\mathbf{10_{23}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.0346847805422	0.261087202067	0.0
0.245456758352	−0.0960492340013	−0.909960844983
0.22484223342	−0.270024572828	0.0745733712032
−0.171071128665	0.399210124353	−0.554217158155
0.457491855053	0.0439197954616	0.137647971545
0.0244101108085	−0.286911689008	−0.700797454041
0.759148469928	0.126090756195	−0.162663154916
−0.123194791675	0.305526796885	−0.597718411183
0.533318181093	−0.438217026749	−0.723558950731

$\mathbf{10_{24}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.0974096864671	0.430500552748	0.0
0.187112398799	−0.418089923402	−0.521390091187
0.555925339239	0.211081649338	0.162802971493
−0.0153925401091	−0.519604772219	−0.210952609186
0.64363942755	−0.341144970289	0.519683390953
0.408365585005	0.383247964567	−0.128314367489
−0.559838427975	0.15135554406	−0.222159423615
0.398416812004	0.325599863106	0.00452496563906
0.809646280234	−0.583208873151	−0.0658810381013

$\mathbf{10_{26}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.348637772012	0.758766925973	0.0
0.681164467759	0.025483919399	−0.593061572592
−0.0144552236728	−0.0899765293982	0.116009742338
0.892906488952	0.207717515435	−0.180761176274
0.195642126755	0.0780417204859	−0.885748124674
0.601863980366	0.726675728401	−0.242119559875
0.163601610177	−0.16458491352	−0.125583887057
0.839511047571	0.544600959778	0.0749200519497
0.801330839793	−0.235074192887	−0.550099090197

$\mathbf{10_{28}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.203982333251	0.605273388003	0.0
0.293349472719	−0.390036590037	−0.0370346054216
0.82906391127	0.373500165443	−0.397619773391
0.0647776290101	−0.0637101103593	0.0764199438079
0.261346872007	0.512638074467	−0.716790811638
0.611084127818	−0.0727740238031	0.0146300843565
0.136429352352	−0.653486498565	−0.646789499406
0.29085002243	0.0389766346897	0.0579438301142
0.242621374372	0.537688959433	−0.807480929559

10_{30}

0.0	0.0	0.0
1.0	0.0	0.0
0.109193226206	0.454382318938	0.0
0.732880141801	0.053838927198	0.671252279438
-0.158540649557	-0.283378805427	0.368509528015
0.504887345897	0.398930002775	0.675621861044
0.848110486707	0.228671769972	-0.248071816413
0.720801803494	-0.326183235607	0.574076845303
0.501041766076	0.649351182008	0.580251471035
0.524198619185	-0.348042670866	0.648583472348
0.765340971759	0.562505020285	0.312795938433

10_{31}

0.0	0.0	0.0
1.0	0.0	0.0
0.203068537825	0.604069734878	0.0
0.0728844414567	-0.026258088194	0.765335832504
0.564630769245	-0.149272813458	-0.09666934525
-0.0260053173015	0.457747189685	0.435003231674
0.536599558007	0.594420186952	-0.380347150736
0.209041306225	-0.182344262667	0.157558585891
0.394569726559	0.791753468384	0.0282805304891
0.465412358717	-0.0779688544561	-0.46015001997
0.879762800392	-0.165236431267	0.445773862882

10_{34}

0.0	0.0	0.0
1.0	0.0	0.0
0.168855351506	0.556056268087	0.0
0.619075796556	-0.333404800147	-0.0784892282688
-0.0388202532942	-0.273370247637	0.672222860416
0.441374422834	0.00594435204063	-0.159279651562
0.229197152155	0.812816984748	0.392025491164
0.343861238139	0.121474075591	-0.321344769881
-0.257371018547	0.40226546539	0.426770173783
0.572077602092	0.436405785749	-0.13076854617
0.851860482027	-0.404071793259	0.333256215325

10_{38}

0.0	0.0	0.0
1.0	0.0	0.0
0.294113146132	0.708324607462	0.0
0.80960232716	-0.147666280669	0.0393764355823
0.00120371964286	0.399969176226	-0.176464009456
0.608012573979	-0.376701255976	-0.00744905733035
0.292936528577	0.309412777403	-0.663173556503
0.00368451579703	0.144267747162	0.279726434
0.357665669213	-0.296175455289	-0.545323339311
0.639743735894	0.262667523909	0.23450131335
0.201563738348	0.88975899854	-0.409513105895

10_{39}

0.0	0.0	0.0
1.0	0.0	0.0
0.409252716697	0.806856646047	0.0
0.0970525177467	-0.0505469694635	-0.409133322873
0.201355458027	0.924315047411	-0.212245170097
0.437337198413	0.154277536897	0.380506759976
0.62629445519	0.390292042811	-0.572694324848
-0.323786340722	0.154372267653	-0.368517095638
0.671977596405	0.229644306426	-0.315712723704
-0.051195097057	0.87771387482	-0.0769092690553
0.867343845168	0.496858650162	0.0290884170855

10_{43}

0.0	0.0	0.0
1.0	0.0	0.0
0.318437803844	0.73176018802	0.0
0.672194137225	-0.0770287703774	0.469805148298
0.68053839043	0.296589141463	-0.457740014694
-0.00815937374958	-0.0636599990237	0.171478505689
0.680010984596	0.0971804845206	-0.536018417801
0.563485984663	0.527426984116	0.359140715524
0.0878877709962	0.609917918156	-0.516645551186
0.0964454071224	0.536177876618	0.480595228735
0.907761080012	0.409683164561	-0.0901638857295

$\mathbf{10_{44}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.323360674893	0.73631462278	0.0
0.641681674809	−0.200752320489	0.143447847126
0.639301667753	0.365101155387	−0.681054535772
0.488951302441	0.379130726291	0.30747869017
0.346594381494	−0.335388236923	−0.377500987095
0.0936910831717	0.618535273508	−0.216039357148
0.791760526519	−0.0957112594431	−0.165532501838
−0.116379869987	0.299489387437	−0.0273389095812
0.698080235015	0.390063083406	−0.600445481659

$\mathbf{10_{57}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.428893883461	0.820876241374	0.0
0.0686311169955	−0.111970211275	−0.00286964790408
0.743493635479	0.35862510766	−0.571289059028
−0.0554927384413	−0.0937996401874	−0.175141836616
0.885194692917	0.0472006314561	0.133445395592
0.184445431237	0.366362597106	−0.504587606641
0.720115842066	−0.359170227833	−0.0725467163318
0.275298237421	0.534799929875	−0.0181899713501
0.965670868343	−0.16534482818	−0.200351845084

$\mathbf{10_{50}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.485797232012	0.857668650117	0.0
0.572433378053	−0.0894221412721	−0.309052117069
−0.121645095767	0.6145337758	−0.158383145483
0.745970920976	0.126523121762	−0.0630518859845
0.271609580468	0.812309065687	0.488925430349
0.344240861817	−0.118239819011	0.130033426876
0.0303497141903	0.514698511468	−0.577682206166
0.275938912601	0.163484520277	0.325830205489
0.78503962778	0.342702413977	−0.516011471064

$\mathbf{10_{64}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.209813694287	0.612866708399	0.0
0.729345700986	−0.240558183716	−0.0418622447455
0.0389702931878	0.456321861529	0.152405608612
0.178944647114	−0.49184731532	−0.132870384627
0.693284631662	0.318607944992	0.14751622584
0.383618652634	−0.492341348583	−0.348939436514
−0.129847381104	0.360104512916	−0.250508316385
0.585453897324	−0.231127348202	0.122035597106
0.663638372804	0.49615971704	−0.559830014673

$\mathbf{10_{53}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.165440675057	0.550918082069	0.0
0.618724605067	−0.330403170872	0.133441102772
−0.0796830562835	0.353846607745	−0.0763897315436
0.795258739075	0.218187562709	−0.541226776361
−0.180707734741	0.350530329813	−0.368094358883
0.242309319728	0.288450438286	0.535898262047
0.436014998865	0.314142063213	−0.444824966126
0.447842860429	−0.284684192855	0.35596665267
0.81030272808	0.585582754829	0.022412632891

$\mathbf{10_{70}}$

0.0	0.0	0.0
1.0	0.0	0.0
0.159287462737	0.541481698388	0.0
0.4529801708	−0.407397467797	0.115641347325
0.826205879375	0.500576208292	−0.0748484791455
0.178660657168	−0.226415521254	0.153555133716
0.632121283963	0.567901660268	−0.250714176379
0.421142134367	−0.211656922267	0.339011365573
0.430485352212	−0.395737114228	−0.643855455114
0.572728317667	0.300201439049	0.0600170254119
0.725661396865	−0.624070869241	−0.289743140151

10_{71}

0.0	0.0	0.0
1.0	0.0	0.0
0.320387658575	0.733571445316	0.0
0.0616074188006	-0.228451970033	-0.0868546822186
0.0736952818751	0.630171526178	-0.599318900795
0.337235356429	-0.0255939007437	0.108154302908
0.190251955558	0.126427253942	-0.869232748569
0.46289651547	0.195970416569	0.0903654446771
0.377459321184	-0.0838720332961	-0.865871288086
-0.0952813710721	0.578946955475	-0.285193041542
0.576145940286	0.0608659601974	-0.815077413735

10_{78}

0.0	0.0	0.0
1.0	0.0	0.0
0.0702881479276	0.368287757217	0.0
0.699058903187	-0.401401557222	-0.110569871884
0.00574787228902	0.243069583261	-0.43302415317
0.700528902036	-0.147369180618	0.170993141586
0.546131555945	0.559483440642	-0.519311741301
0.684486011823	-0.425352188249	-0.41463687037
0.669143108953	0.522017619035	-0.0948634449937
0.00301254274833	-0.153909529148	-0.410129299655
0.95366934707	0.124761362721	-0.273768841965

10_{72}

0.0	0.0	0.0
1.0	0.0	0.0
0.185124295234	0.579635735426	0.0
0.510953727221	-0.327920233434	-0.264910068965
0.822328010952	0.535970952401	0.130991527987
0.371876190178	-0.161260988654	-0.426647044508
0.0083737506473	0.513057065964	0.216129073337
0.75268629593	0.165295821487	-0.354012094949
0.272613171031	0.0868965695551	0.519706024381
0.783724308974	-0.480929525853	-0.125537286351
0.865959858257	0.491186604634	0.0940704167953

10_{82}

0.0	0.0	0.0
1.0	0.0	0.0
0.00198841281888	0.0630307214954	0.0
0.785485379849	-0.254089794799	0.534384768495
-0.0919290260395	0.224766125139	0.505385315401
0.566361372812	-0.521856649678	0.409426038075
0.46623957643	0.472903308691	0.430120267107
4.78041181243e-05	-0.359902147359	0.728617007125
0.408232791455	0.0140024226121	-0.104197731378
-0.091722610888	0.162378789091	0.749048452052
0.696425137039	-0.428236289777	0.575852158646

10_{73}

0.0	0.0	0.0
1.0	0.0	0.0
0.407001535847	0.805203590102	0.0
0.785502467186	-0.119188399404	0.0472915924133
-0.0792188109147	0.108677588645	-0.40029549709
0.769478833134	0.343368968889	0.0736583667244
0.127605669383	-0.394704013903	-0.134301037316
-0.00851801922864	0.179313675913	0.67314805283
0.297777724356	0.020755500625	-0.265490441219
-0.19180596616	-0.485708519499	0.444299673041
0.479158651293	-0.854936526472	-0.198722224715

10_{84}

0.0	0.0	0.0
1.0	0.0	0.0
0.170768676687	0.558905548762	0.0
0.423598764798	0.16429555611	-0.883379816526
0.647761944004	-0.0885709207564	0.0577946699352
0.359461924174	0.84081605746	-0.172689479817
0.181166107691	-0.114631632232	0.0625344859822
0.29993173492	0.625219376513	-0.599670324215
0.568765118194	0.362872389495	0.327099696039
-0.0290387357943	-0.0080280336008	-0.383578450737
0.714958576275	0.648754304127	-0.260676211203

10_{95}

0.0	0.0	0.0
1.0	0.0	0.0
0.314323185864	0.727906111086	0.0
0.15854657216	−0.0638521329385	0.590637392689
0.822703347529	0.17771597666	−0.116851565639
0.124138078041	0.44054944913	0.548674639717
0.341600062394	0.340734857275	−0.422277126652
0.0695964950563	−0.278582906643	0.314241418023
0.700324158866	0.497352332484	0.303891597472
0.229222278409	0.0537350905829	−0.458516928791
0.487161224639	0.871516389063	0.0559743227134

10_{101}

0.0	0.0	0.0
1.0	0.0	0.0
0.121037379708	0.476890671045	0.0
0.673848032866	−0.0752703039723	0.624114283944
0.703035373024	0.26691529719	−0.315064673195
0.139531953501	−0.55557936793	−0.237822055195
0.628442824865	0.110511846542	0.325461757696
0.418304825606	0.404397596343	−0.606993703616
0.950249041541	0.0298422313653	0.152442685886
0.408727382618	0.0786083840306	−0.686828518953
0.7028698385	0.710682040006	0.030083685623

10_{97}

0.0	0.0	0.0
1.0	0.0	0.0
0.395396071274	0.79652626408	0.0
0.714699503641	−0.149848714553	−0.0491906281372
0.555497228911	0.782918825237	0.274227603316
0.270047118355	0.46288756802	−0.629153948847
0.855498881324	0.439454694168	0.181214568347
0.0652659040237	0.950196242826	−0.157422275576
0.813303158809	0.494704941589	0.325245249694
0.480508730921	−0.261730651822	−0.237829400586
0.583005253885	0.724484061909	−0.367733215773

10_{105}

0.0	0.0	0.0
1.0	0.0	0.0
0.106009659246	0.448086231252	0.0
0.271045399884	−0.387341875828	0.524235712455
−0.269549185212	0.143345341137	−0.128549529654
0.411294402503	−0.133967889647	0.549351186602
−0.0559780088004	−0.0833427063963	−0.333311594111
0.264100942146	0.289604084389	0.537584585926
0.720011357396	0.211343343304	−0.348993639428
0.173864408556	−0.211384069808	0.374211064979
0.54224567066	0.715980856764	0.43970563494

10_{100}

0.0	0.0	0.0
1.0	0.0	0.0
0.0402748237425	0.280940538295	0.0
0.109740614827	−0.712466329215	0.0911992294558
0.322196503546	0.170282916063	−0.327866714411
0.254925516664	−0.674247658512	0.203398495189
0.539513066731	0.245551440576	−0.0667487677333
−0.000872706812756	−0.226695850185	0.629646028428
0.190466629846	−0.605982232579	−0.275633540753
0.298579472629	0.334147816297	0.0475801724853
0.634123027193	−0.36019097526	0.68421520571

K11a66

0.0	0.0	0.0
1.0	0.0	0.0
0.339741095758	0.751038067856	0.0
0.780045398445	−0.0911245018757	0.311278536327
0.078552549971	0.516992854742	−0.0603409789297
0.958247950985	0.151916077875	0.244380120482
0.0917368106448	−0.339259873049	0.333288100433
0.842574040489	−0.0490689688869	−0.260035330271
0.584522464229	0.513388297478	0.525490740272
0.522771697078	−0.294394690056	−0.0607459762564
0.736633192395	0.660137312497	0.146936273643

K11a71

0.0	0.0	0.0
1.0	0.0	0.0
0.0748898283717	0.379698788976	0.0
0.938060450371	−0.0553903382459	−0.256191195574
−0.00904632743941	−0.36885727782	−0.187436346881
0.305954153069	0.485777532853	0.225327553753
0.119702128635	−0.120086117979	−0.548131831086
0.14457681649	−0.0814814227193	0.450813076008
0.389947872613	0.46293951702	−0.351308414285
0.602274422031	−0.248004766061	0.319121047154
0.807979342999	0.499593572343	−0.312371003393

K11a125

0.0	0.0	0.0
1.0	0.0	0.0
0.0971238552555	0.429900764423	0.0
0.483112969606	−0.487229105768	−0.0994243672696
0.560981075776	0.481188316922	−0.336287731831
0.365374361464	−0.0963713750694	0.456279499073
0.505338198661	−0.450238457146	−0.468484369436
0.642619215613	0.288194603442	0.191720551338
−0.124304249067	−0.309850078719	−0.0410260006474
0.480065887721	0.260661518067	0.515079435121
0.880290290115	0.253065791834	−0.401306254789

K11a72

0.0	0.0	0.0
1.0	0.0	0.0
0.201830587044	0.602433057046	0.0
0.55960072562	−0.0705117176434	0.647414749725
0.552227354945	0.329448218761	−0.269088214087
0.362304568222	0.641748524134	0.661716735592
0.46732406308	−0.071909964915	−0.0308599509258
0.32400928626	0.900455653441	0.1534386627
0.511110508207	0.155994412353	0.794352536215
0.402149622727	0.0704194031444	−0.196003179291
0.453133502706	0.628403570004	0.632280777765

K11a170

0.0	0.0	0.0
1.0	0.0	0.0
0.288503292396	0.702689430024	0.0
0.0632993852281	−0.270890962256	0.0377414886212
0.913016577611	0.251406187766	−0.034275037588
0.128484652373	−0.0437953071736	0.511037474343
0.176825438894	0.00521387831171	−0.486590346088
0.314508906383	0.289610584922	0.462178211596
0.603663753474	−0.665070003683	0.39164844381
0.864250159984	0.0672301006073	−0.237502795558
0.675827788992	−0.0999507484181	0.730251085255

K11a81

0.0	0.0	0.0
1.0	0.0	0.0
0.33287210277	0.744943198329	0.0
0.367917772646	−0.252288215681	−0.0655843573945
0.333911258269	0.694444172315	0.254636414105
0.404705267461	0.240913902895	−0.633788317081
0.314409434769	−0.0761746041938	0.310299359606
0.707325644476	0.434783986311	−0.454251600723
0.807255780775	0.0466200326753	0.461904888616
0.407002794697	−0.104176875054	−0.442007629139
0.766684937718	0.627128138765	0.137493650198

K11a215

0.0	0.0	0.0
1.0	0.0	0.0
0.114790811713	0.465193178123	0.0
0.551660405254	−0.114288638506	−0.688001295373
0.679927791074	0.346251479186	0.19032112705
0.0710158578516	−0.363664014467	−0.163580341513
0.765479142101	0.285647187586	−0.473605678731
0.407585630724	−0.0205261792896	0.408533824936
0.274315884539	0.353143014241	−0.509404358472
0.317038758977	−0.219574099997	0.309234672517
0.615213283162	−0.512177469752	−0.599321996676

K11a228

0.0	0.0	0.0
1.0	0.0	0.0
0.176687093012	0.567587752852	0.0
0.403661131304	−0.284226945814	0.472117045953
0.703414154061	0.466370334007	−0.116739344753
−0.2511914773	0.322494506761	0.144082116997
0.706438518632	0.24498431726	−0.133293010609
−0.030236010055	−0.423407657855	−0.0305174960919
0.175327918207	0.551625589237	0.0534684459602
0.617932994728	−0.274067125828	−0.296291881301
0.812257743647	0.481268991733	0.329571715232

K11a270

0.0	0.0	0.0
1.0	0.0	0.0
0.33887055239	0.750271853066	0.0
0.35818708031	−0.239239423607	−0.143158321751
0.395814812922	0.395497959355	0.628652930052
0.269302280325	0.312522034238	−0.359835600457
0.93900205505	0.0348015297123	0.328912200338
−0.00344395427602	−0.228721693832	0.123118541158
0.582709362717	0.490543840151	−0.249817620406
0.139546656639	0.27319678942	0.619876047204
0.827977684844	0.558802510732	−0.0468263536912

K11a261

0.0	0.0	0.0
1.0	0.0	0.0
0.136557465726	0.504447212309	0.0
0.530253846687	−0.391667201512	0.204895380525
0.606592125766	0.542046205324	−0.144892756841
0.233954386858	−0.19777923478	0.415285280676
0.0272849514324	0.314354289007	−0.418385516626
0.640254164563	0.285688677412	0.37120110083
0.389004327327	−0.311035272221	−0.390897348993
0.0124150661894	0.513650019494	0.0310916295643
0.909865540403	0.214423804223	0.355200127491

K11a277

0.0	0.0	0.0
1.0	0.0	0.0
0.180352164773	0.572867721388	0.0
0.0418044871203	−0.409384826629	0.126429715383
0.655834548846	0.375937215277	0.047459000598
−0.18061966585	0.839221617895	−0.245306962258
0.467241142221	0.195379542921	0.161809428788
−0.0276442057849	−0.519659972912	−0.331958718348
0.145386884423	0.330516388425	0.165294131261
0.943004477783	−0.234114570082	−0.0468333197167
0.685947496629	0.714811665616	0.136089362431

K11a267

0.0	0.0	0.0
1.0	0.0	0.0
0.442901125602	0.830446171732	0.0
0.518699498806	−0.164337773078	0.0682606018706
−0.167401726685	0.097019762911	−0.610677795011
0.107844879657	−0.0528526992897	0.338941892427
0.199354938016	0.653057675774	−0.36342300675
0.819866851733	0.274374020272	0.32328191823
0.130112539736	−0.0625296613011	−0.31760410785
0.230457667995	0.43883508223	0.541793500465
0.960751849056	0.252279635008	−0.115372745031

K11a281

0.0	0.0	0.0
1.0	0.0	0.0
0.395671789112	0.796735472742	0.0
−0.0163052699443	−0.11013705299	−0.0886404246565
0.947525482587	0.15561086155	−0.108847512328
0.2752962239	0.658505154115	0.434480339224
−0.00983629969592	−0.138274900537	−0.0982869537813
0.585924163229	0.426446094741	0.472816949468
0.210032124413	0.85706870671	−0.347712965413
0.422514594372	0.392748842747	0.512088327845
0.962954433716	0.0633241914617	−0.26212364518

K11a285

0.0	0.0	0.0
1.0	0.0	0.0
0.109118969452	0.454236710768	0.0
0.303275553344	−0.329544062074	−0.589907552972
0.855901068494	0.193497587058	0.0589625983508
0.21146935351	−0.476686167712	−0.309224174313
0.0665425758475	0.377383593129	0.190336705595
0.814000274673	0.328165012273	−0.472146894025
0.656742034832	−0.0924913251341	0.421339587015
0.123345570368	0.0148810884422	−0.417683283055
0.878736084457	0.474776396	0.0490944770317

K11a315

0.0	0.0	0.0
1.0	0.0	0.0
0.0603363657919	0.342099772796	0.0
0.297033075758	−0.564245875929	0.350017474606
0.332154727939	0.31899613536	−0.117582802386
−0.0315110827628	0.286975811105	0.813396186078
0.309503737865	−0.0532988749636	−0.0629154195354
0.136140423717	0.912687949134	0.128955935746
0.618683312827	0.329195447857	−0.524258317867
−0.0175609294717	−0.0323597149354	0.157262869185
0.521637245747	0.796735954068	0.305133418924

K11a288

0.0	0.0	0.0
1.0	0.0	0.0
0.151924832478	0.52987593853	0.0
0.323239386995	−0.455178391014	−0.0178687228438
0.743394613599	0.222742716107	−0.621103799804
0.0911559780094	0.351068530739	0.12596865153
0.620310484423	0.00461896282285	−0.648607494005
0.663982321881	−0.0261072954365	0.349965822114
0.175483652395	0.22516052927	−0.485637869942
0.719366386838	−0.219235972249	0.226193093569
0.710193839655	0.241553711934	−0.661268866927

K11a316

0.0	0.0	0.0
1.0	0.0	0.0
0.167770941524	0.554431956355	0.0
0.562074275618	−0.349623565093	0.164949976846
0.0376019517958	0.109376848149	−0.552160476423
0.738579382638	−0.218860831535	0.0809987982351
−0.149780753683	0.15917948089	0.341578518048
0.634360641613	0.448508228238	−0.20743072426
0.764035631904	−0.169913771441	0.567642580148
0.239477247675	−0.138823770525	−0.28316404499
0.895413906429	0.288962250395	0.338725189526

K11a313

0.0	0.0	0.0
1.0	0.0	0.0
0.0780113405744	0.387216879656	0.0
0.759522288411	−0.337380181754	−0.10247890795
0.203971185402	0.0890641688022	−0.816277330353
0.392947966545	−0.0719000735103	0.152421946454
0.423364635031	−0.299638140409	−0.820825298168
0.581578723258	0.0487846157605	0.103063161155
−0.237588444843	−0.459630407043	−0.162416245378
0.551469483914	0.0705853753835	−0.472672283402
0.232391894785	−0.875838836843	−0.42296612053

K11a326

0.0	0.0	0.0
1.0	0.0	0.0
0.33961897095	0.750930686862	0.0
0.392136567459	−0.247678154016	−0.00472069665456
0.526124020909	0.733888916705	0.131563741175
0.825243976516	−0.173644147561	−0.163242957226
0.363696583016	0.502256105164	−0.737814842998
0.0601870370218	−0.215849390352	−0.11155095868
0.53983258221	0.615592476015	0.168885440228
0.183518223849	0.23577338859	−0.684799243278
0.83877638394	0.544456130423	0.00465830329687

K11a344

0.0	0.0	0.0
1.0	0.0	0.0
0.0110533870865	0.148272036497	0.0
0.684167770689	−0.120859821246	0.688828766629
−0.0336501892326	−0.194539806416	−0.00349242775951
0.64353474309	0.537237962684	0.0734612211798
0.253171860349	−0.361628099169	−0.125678485124
0.508903265133	0.10236150631	0.722445971907
0.408427036488	−0.0305425389338	−0.263576868718
−0.170323502082	0.0662831634372	0.546159259576
0.742329030071	−0.341319225118	0.576583729981

K11a345

0.0	0.0	0.0
1.0	0.0	0.0
0.012451311218	0.157313658927	0.0
0.643693334046	−0.604507461066	0.145471955198
0.112820256307	0.208679431404	0.384010952529
0.973137354424	0.0858769337105	−0.110735484798
0.476711062543	−0.409999800156	0.601772200451
0.535980401268	−0.367590131796	−0.395568546494
0.412470061546	0.31737103933	0.322465846855
0.455131899634	−0.670374551371	0.172337183295
0.920353281496	0.199485904351	0.336385509802

K11a350

0.0	0.0	0.0
1.0	0.0	0.0
0.0867845179942	0.407476972877	0.0
0.374956463695	−0.277518009338	0.669132874735
0.26029321846	0.298387532213	−0.140302204442
−0.412229839099	0.683488520846	0.4916866923
0.00665447391576	0.603260238168	−0.412801757028
0.229000839585	0.0207806605189	0.369041983943
0.367648177795	0.86056739678	−0.155872440709
0.167553280937	−0.108551883808	−0.0117549461292
0.554747586431	0.610876489966	0.564876118592

K11a351

0.0	0.0	0.0
1.0	0.0	0.0
0.277288992711	0.691150345398	0.0
0.0604391432561	−0.190761344648	−0.418578443964
0.473258505933	0.153119536154	0.424823069918
0.193435006404	0.84726838536	−0.238393474098
0.304578518855	−0.100922092769	0.0592337034667
−0.0983854350259	0.750103971429	−0.277477879239
0.71102059869	0.58173545487	0.285117815035
−0.154587688085	0.710750911852	−0.198697548225
0.807780741359	0.587862721783	0.0436771591021

K11a352

0.0	0.0	0.0
1.0	0.0	0.0
0.0231848709015	0.214084571056	0.0
0.556254592485	−0.15953216724	0.759109481429
−0.185399758324	0.473799175884	0.538111215049
0.210477061724	−0.226725763094	−0.0556449244718
0.172382529485	0.210531308026	0.842884463122
0.23578186142	0.0757659208648	−0.145962752141
0.0963814932267	−0.600277500424	0.577592933262
0.0883378653456	0.373437227774	0.349964006848
0.605857883846	−0.417069951922	0.677487180532

K11n1

0.0	0.0	0.0
1.0	0.0	0.0
0.136361548564	0.504111718968	0.0
0.457960980606	−0.315733546655	−0.473737844959
0.639435132202	0.124286586109	0.405721884116
0.41464750435	0.400033695649	−0.528855054367
−0.293173549582	0.394458347684	0.177514729178
0.625496445091	−0.00056036537069	0.175136237075
−0.315263894149	−0.157019313467	−0.12568028786
0.347880464475	0.578421944884	0.0134804650146
0.980633950487	−0.195549309394	−0.010840790914

K11n3

0.0	0.0	0.0
1.0	0.0	0.0
0.244960037704	0.655678774505	0.0
0.538687743526	−0.294319170133	−0.105961974393
0.0467896511574	0.407970197047	0.408650415149
0.769167769077	0.500931165008	−0.276570799633
0.839216940258	−0.355775377878	0.234454652759
0.586034744482	0.539924138621	−0.131087618236
0.15495088408	−0.153998545216	0.445660172533
0.413712789345	0.397302007367	−0.347504360906
0.938604347933	−0.132872241301	0.318381603636

K11n8

0.0	0.0	0.0
1.0	0.0	0.0
0.459257595386	0.841188238061	0.0
0.272077869424	−0.139703142721	−0.0530645766598
0.313773296942	0.770667557267	−0.464752176579
0.307859825736	0.359159519793	0.446634769758
0.09234425394	0.228863843132	−0.521133836345
0.740192162914	0.584280731567	0.152640548931
0.0729519157638	0.662178145236	−0.588117471968
0.0719968497262	0.738930369875	0.408932267945
0.883036722592	0.457637760465	−0.103989551159

K11n5

0.0	0.0	0.0
1.0	0.0	0.0
0.029709019705	0.241940929895	0.0
0.609701860846	−0.570079847941	0.0650427596858
−0.16140097015	−0.12922125616	−0.394352632196
0.46718102616	0.161875608688	0.326859742345
−0.199293561622	0.12237745344	−0.41762096229
0.251626019009	−0.696766441892	−0.0631145299869
0.336638872238	0.185201859978	−0.526692710321
−0.0509594151156	−0.0788449063911	0.356509912416
0.865120992816	0.321115377338	0.385292852549

K11n10

0.0	0.0	0.0
1.0	0.0	0.0
0.226663201677	0.633995422979	0.0
0.751343557609	0.0471718956335	0.616724145669
0.0237840652591	0.232901929688	−0.0437011260618
0.658084927242	−0.295309656393	0.520794167822
0.331078357966	0.109281976589	−0.333238802368
0.569998605616	0.432092479402	0.582572583528
0.465685647977	−0.161963782341	−0.215058888238
−0.271046770675	0.255412619098	0.316939497877
0.558935585863	0.802564320765	0.208522233568

K11n7

0.0	0.0	0.0
1.0	0.0	0.0
0.363892690292	0.771600602991	0.0
−0.0253405063851	−0.0784808242785	0.354766240806
0.298322418368	0.226773597272	−0.540812928929
0.00394389297677	0.555895883743	0.356416029774
0.0223624912859	−0.320489594375	−0.124841956113
0.174239589414	0.624855408715	0.163699500522
0.593215127758	−0.281959390206	0.210028959046
−0.208577581909	0.303590191792	0.0906131403851
0.694400196746	0.719368102439	−0.0178297490652

K11n11

0.0	0.0	0.0
1.0	0.0	0.0
0.0704614678548	0.368724988653	0.0
0.798041555738	−0.0795004207186	0.519346895735
0.219287521517	−0.545582504035	−0.149840118099
−0.0967564442132	0.0951621161034	0.549847343193
0.686268791532	0.197941681808	−0.063592010826
0.261523911272	−0.681021161392	0.153239967825
0.52195836748	0.0740952637094	−0.448402017546
0.742970315327	−0.0222185834327	0.522101646412
0.659208485342	−0.730345012471	−0.178998144156

K11n13

0.0	0.0	0.0
1.0	0.0	0.0
0.426503939435	0.819208318144	0.0
0.0697305730166	-0.0747449367179	-0.271220100909
0.627633744637	0.446818118904	0.374315359082
0.102564744228	-0.387640653231	0.207039830643
0.248600431208	0.397397009399	-0.394948081511
-0.0291842229978	-0.265602478686	0.300226259706
0.74649009321	0.124004361187	-0.196297521699
0.389830042335	0.569408412224	0.624926466887
0.717854455045	0.619099472732	-0.31843496076

K11n18

0.0	0.0	0.0
1.0	0.0	0.0
0.169589446832	0.557151965973	0.0
0.70825054881	0.0596943578805	0.679985400849
-0.179642638435	0.344710350953	0.318859977018
0.695742604411	0.483753681276	-0.144138542309
0.170366817598	-0.316852348904	0.143976481715
0.125573746796	0.654852870084	0.375887128732
0.814780571522	-0.0361980422545	0.59370032693
0.350410196686	0.168371694961	-0.267990671973
0.675933165428	0.315459209409	0.666032914407

K11n15

0.0	0.0	0.0
1.0	0.0	0.0
0.00219466735287	0.0662156940683	0.0
0.980490728946	-0.139627773078	-0.0237756788468
0.148215851934	0.352522804091	0.23138375854
0.499643292333	-0.571884450225	0.379606504105
0.23632053146	0.372466616946	0.576741446563
0.670694248837	-0.0475967406955	-0.220043498839
0.131666463161	-0.148661680496	0.616159182461
0.411968581087	0.09294885869	-0.312848390189
0.776954086273	0.121468532665	0.617727887824

K11n21

0.0	0.0	0.0
1.0	0.0	0.0
0.0125742187566	0.158083289869	0.0
0.15285031146	-0.805468202488	0.227796267294
0.395974771763	0.0750682115727	-0.179077325259
-0.135008740475	-0.0676059024833	0.656207420747
0.437631495828	-0.38495616527	-0.0996840863339
-0.230577874991	0.0861330198111	0.476138122729
0.751249524711	-0.00557612584272	0.309992434255
-0.10042572432	-0.413148390465	-0.0194527346251
0.23750789294	-0.32015104874	0.917111392788

K11n16

0.0	0.0	0.0
1.0	0.0	0.0
0.122921239204	0.480346590871	0.0
0.505349818427	-0.381760100683	-0.33244613725
0.747721269726	0.277276249117	0.379542043296
0.0961254158668	0.140583452762	-0.366606683606
0.672239176713	-0.211623708976	0.370986056179
0.641739240825	0.63077285137	-0.167008171512
0.344161258822	0.199924382179	0.684940736125
0.919766567126	0.215736802428	-0.132634028908
0.690843302218	-0.541485443554	0.479091897447

K11n23

0.0	0.0	0.0
1.0	0.0	0.0
0.425255239629	0.8183327321	0.0
0.6170739816	-0.0680403480531	0.421364845483
0.222256431434	0.181947218624	-0.462730917762
0.535874973867	0.542898644646	0.415538675185
0.616744166893	0.0294108964321	-0.43873909349
0.12628747264	0.806040122739	-0.0433920612393
0.825252995842	0.0936057377244	0.018933250034
-0.0434672207007	0.36456454479	-0.395682849803
0.837509436757	0.544822057743	0.0417955588508

K11n26

0.0	0.0	0.0
1.0	0.0	0.0
0.194671376281	0.592828649628	0.0
0.513125454944	−0.304314198574	−0.306140016501
0.273821231933	0.290633598787	0.461173874462
0.302341782162	0.599038928972	−0.489653518143
0.168607439638	0.00603348771066	0.304361388684
0.621331802944	−0.776256916187	−0.123496502256
0.807136125827	0.179519188809	−0.351463146126
0.0179501646698	0.0685664234325	0.252585695085
0.595270048362	0.79425997613	−0.121674400927

K11n32

0.0	0.0	0.0
1.0	0.0	0.0
0.104351391055	0.444762373966	0.0
0.775900062902	−0.262105960718	−0.222170067207
0.0121406502929	−0.190878473541	0.419389130935
0.226737584803	0.348148865029	−0.395103155077
0.631087703247	−0.0838660847488	0.411038311964
0.0162026487238	0.404679447126	−0.208025200941
0.763729057861	−0.0217678565966	0.301235994116
−0.0994153609675	0.0852744970687	−0.192245157264
0.508446767878	0.860816444028	−0.0218388169417

K11n29

0.0	0.0	0.0
1.0	0.0	0.0
0.0816396703112	0.395745252472	0.0
0.496098723221	−0.272591631069	0.617696935043
−0.149951127901	0.370507849912	0.206548972105
0.680447465421	0.0368993139963	−0.239706023356
0.510145670136	0.500189072414	0.629983517956
−0.158156182682	−0.222140883493	0.45218568805
0.647677016208	0.363483418058	0.364567008534
−0.13906766809	0.123499777564	−0.204151422699
0.479151649267	0.877554157212	0.0176747889628

K11n33

0.0	0.0	0.0
1.0	0.0	0.0
0.0354970092577	0.264071923629	0.0
0.784959641626	−0.221389992128	0.450147188188
0.710423850685	0.279672805696	−0.412047968667
0.100674048277	−0.284063253058	0.145093696014
0.433997275842	0.631669482879	−0.0792479681922
0.749904341619	−0.269494349091	−0.376075314879
0.819604170366	0.327136409614	0.423408063085
0.312863672619	−0.0194332263618	−0.365961023821
0.890361299783	0.126909493945	0.437207886704

K11n30

0.0	0.0	0.0
1.0	0.0	0.0
0.205845759892	0.607716251978	0.0
0.638845261949	−0.274006913936	−0.187285049881
−0.0792438808121	0.13400836156	0.37651590614
0.605744950579	0.0956323540695	−0.351026245848
0.105800491252	0.728337525641	0.240361700813
0.777988179658	−0.00975492574602	0.298527367326
0.252524542888	0.711782496918	−0.152329277437
0.24170692245	−0.0535164129802	0.491254872147
0.796601187341	0.604233742597	−0.0181144316278

K11n52

0.0	0.0	0.0
1.0	0.0	0.0
0.04420866862	0.294045797213	0.0
0.375885925929	−0.644416022041	0.0963307364554
−0.0647554813636	0.176103813572	0.460449329148
0.600479226674	0.0441777061097	−0.274437250803
−0.101941274068	−0.117537052792	0.418710480126
0.806737666553	0.294732264162	0.484563294586
−0.0110862771608	−0.264913922191	0.350547835815
0.309853116034	0.675865950519	0.241318091703
0.35789514583	−0.0450489757457	0.932674463237

K11n53

0.0	0.0	0.0
1.0	0.0	0.0
0.251131705809	0.662718852875	0.0
0.104075112903	−0.302316692319	−0.216981001462
−0.236745209798	0.623638160764	−0.0543491543799
−0.182054972502	−0.374765728839	−0.0402547877938
0.500071429165	0.257563740051	−0.40749178882
−0.19231234164	0.154145014936	0.306587535361
0.0106991238919	0.275550601102	−0.665033290121
0.426258491276	−0.0993025071297	0.163698004949
0.587940542895	0.66491855984	−0.460661727084

K11n55

0.0	0.0	0.0
1.0	0.0	0.0
0.125053378644	0.484219381869	0.0
0.200339440413	−0.484904036457	0.234801637463
0.356651964081	0.334054902398	−0.317351105367
0.0436339836909	−0.133822600531	0.509153816703
0.304780433524	−0.0028899526342	−0.4472243373
0.772247437609	0.244120100775	0.40157518768
0.0772246668925	−0.383072165864	0.050045375496
0.563579523311	0.336640952418	−0.445405914754
0.849199345195	−0.527195164694	−0.0304258187024

K11n56

0.0	0.0	0.0
1.0	0.0	0.0
0.195790558341	0.594346005241	0.0
0.141536570633	−0.401090766291	0.0784992910798
0.413981288647	0.213880158501	−0.661490328636
0.331496549532	0.183160109192	0.33462841247
−0.381893097251	0.0833376212685	−0.358993013646
0.574249064562	−0.0557339129589	−0.616774461333
0.169603718764	0.221039921765	0.254809377742
−0.00595408780307	−0.403756929312	−0.505985174971
0.927801250918	−0.0745469142358	−0.36555108586

K11n58

0.0	0.0	0.0
1.0	0.0	0.0
0.207238762921	0.609532296917	0.0
0.734424369131	−0.138348480007	0.403422458612
0.0922081541774	0.255904870888	−0.25393789048
0.347089645351	0.21109609517	0.711995647127
0.731699246896	−0.114122954232	−0.151895563793
0.422948988017	0.591173004938	0.486250883052
0.122844400161	−0.19086990208	−0.0599598161578
0.502632013236	0.667309118788	0.285424226752
0.978773517559	−0.188071986985	0.0814329726575

K11n59

0.0	0.0	0.0
1.0	0.0	0.0
0.22308709159	0.629608078685	0.0
0.334933651411	0.184791480066	0.888610454952
0.325067761039	0.573391956498	−0.0327430786739
0.381176535158	−0.313072894365	0.426638977626
0.62764910808	0.129506996047	−0.435552597025
0.312444592392	0.631422845147	0.369883057582
0.0780856202491	0.081319225618	−0.43165414053
0.0769600578538	0.0736554192294	0.56831585861
0.56243315533	0.81924931131	0.111801215123

K11n60

0.0	0.0	0.0
1.0	0.0	0.0
0.166601158121	0.552672027838	0.0
−0.0988108394204	−0.408916790656	0.0700243936739
0.384892410094	0.448219575455	−0.107030446135
−0.417960174093	−0.113301455189	−0.30733486498
0.219425374036	0.0466476512829	0.446426334854
0.355724931576	0.548628602583	−0.4076448303
0.409180559431	0.715819467539	0.576829501781
0.185675389292	0.0103339124447	−0.0957294699636
0.174327316733	0.961285069076	0.213403380038

K11n63

0.0	0.0	0.0
1.0	0.0	0.0
0.300685992794	0.714814604863	0.0
0.0991656310342	-0.15721028673	-0.446051714759
-0.0878918202108	0.804363774981	-0.245091933265
0.390313449604	-0.0337525001902	0.0173596417238
-0.139732612105	0.433539185747	-0.690234629537
-0.436753672787	-0.499701039161	-0.488142640271
0.289330763678	0.174648150836	-0.353775378362
0.0271156759684	0.262877740932	0.607192252315
0.574187361678	0.818505777339	-0.0188988399821

K11n67

0.0	0.0	0.0
1.0	0.0	0.0
0.0864328653306	0.406687952184	0.0
0.423734416712	-0.477646476545	-0.322769703659
-0.235309137005	0.268368623814	-0.418284437288
0.490567784198	0.139414755029	0.257343859181
-0.185986083047	0.150869869013	-0.478960184729
0.204351118381	-0.176880502135	0.381398207682
0.183921072787	0.333753122179	-0.478157442032
0.226586897629	0.0294176666479	0.473451489145
0.648209297797	0.758639798342	-0.0655008596978

K11n64

0.0	0.0	0.0
1.0	0.0	0.0
0.00809707190395	0.126998351306	0.0
0.583246337016	-0.204521946001	-0.747862029598
0.377742936249	0.100896334003	0.181916452898
0.277274744181	0.520883818448	-0.720035128559
0.51075196653	-0.0141110849473	0.091918589325
0.0344686102373	0.0389542809733	-0.785770553514
-0.179305902483	0.382223659265	0.128814921791
0.612728571479	-0.189906493669	-0.084136904122
0.24036623236	0.101179653595	-0.965394609494

K11n68

0.0	0.0	0.0
1.0	0.0	0.0
0.0590916739052	0.338661367571	0.0
0.558028271453	-0.527812315453	-0.0169005400529
0.182643764695	0.368752639224	0.218169139259
0.93437456452	-0.222965405504	-0.0729847034736
0.369362851736	0.374880116051	-0.641616831281
0.114843408032	0.201534838564	0.309788060209
0.892077030896	0.31612444866	-0.308901778684
0.364577209197	-0.185585963788	0.376685998445
0.615439396514	-0.617743770945	-0.489517091303

K11n66

0.0	0.0	0.0
1.0	0.0	0.0
0.0605155430435	0.342591528116	0.0
0.338677730049	-0.242942857083	0.76142976135
0.482505523461	-0.207086796228	-0.227523174204
-0.108792564152	0.103487022782	0.516728446238
0.129427863617	-0.275683773928	-0.377408307685
0.0685326623931	0.513115503921	0.234218599614
-0.00683511202605	-0.412715009247	-0.136129290167
0.891319328952	0.0262775034678	-0.111549340393
0.559556237503	-0.169549263429	0.811264361563

K11n69

0.0	0.0	0.0
1.0	0.0	0.0
0.0607740652998	0.34329964111	0.0
0.343205237985	-0.346749736082	0.666381639703
0.715531851863	0.171288045629	-0.103689622791
-0.282681013574	0.224921330697	-0.0773353819624
0.360421467403	-0.160020344194	0.584660921572
0.375433746603	0.0105129210426	-0.400576631976
-0.239392734929	0.0712232215558	0.385745602874
0.356957203931	0.163580442931	-0.411648210798
0.536230989541	0.757272292008	0.372820334227

K11n87

0.0	0.0	0.0
1.0	0.0	0.0
0.499245598141	0.865589411337	0.0
0.486288379548	−0.117276466758	0.183866190917
0.185521589879	0.58849025871	−0.457563982565
0.776424344128	0.541082161917	0.34778464218
0.135498680039	0.311213927128	−0.384591550597
0.636215217663	0.650974044219	0.411552916057
0.39587019711	0.456266321353	−0.539406164951
−0.0928555916968	0.51809492203	0.330837667255
0.834309980029	0.549656349182	−0.0424824084465

K11n93

0.0	0.0	0.0
1.0	0.0	0.0
0.448979074152	0.834491425527	0.0
0.0845038793816	−0.0537150114923	−0.279726934055
0.0938104094222	0.35333299954	0.633632417577
0.445089284659	−0.364005820877	0.031944650928
0.8378797511	0.546569933557	−0.0967699360813
0.305440085744	−0.205651638047	0.291393315617
0.302118358118	0.69491973066	−0.143302182394
0.67878289974	−0.182936633452	0.152488329747
0.64200949818	0.451037698069	−0.619990967004

K11n89

0.0	0.0	0.0
1.0	0.0	0.0
0.153761100914	0.532803646453	0.0
0.335428277185	−0.401703696606	−0.306093225727
0.0103634553443	0.54393908073	−0.296470374043
0.413737057248	−0.283717609017	0.0937528200454
0.45693795378	0.691956720802	−0.121173410722
−0.13064700576	−0.0281619920958	−0.490189609089
0.615669652328	−0.020210398897	0.175353941722
−0.162560195234	−0.470544563405	−0.262318818045
0.602301759009	−0.103271245643	−0.791560257288

K11n97

0.0	0.0	0.0
1.0	0.0	0.0
0.296087228386	0.710286428111	0.0
0.666789758344	−0.218121169465	−0.0252777974758
0.275095577564	0.202024811281	0.793289868393
0.425120297889	0.627320143123	−0.0992438643056
−0.0108560326807	−0.184768348912	0.288618121827
0.753917701323	0.378756813085	−0.0237286847428
0.35971490457	−0.51316559107	0.197808174489
0.568717062858	0.313426434551	−0.3247468188
0.777837071367	0.0759228147935	0.623863139319

K11n90

0.0	0.0	0.0
1.0	0.0	0.0
0.0795523381739	0.390865836111	0.0
0.910058228231	−0.154310806642	0.114203304583
0.275707990589	−0.375351605802	−0.626567065444
0.398456958876	0.216036740909	0.170422592054
0.321942911154	0.396502785584	−0.810178043894
0.737744293287	0.144580107714	0.0636893230399
−0.253867014872	0.113095872489	0.189051823273
0.480978957207	−0.382599081828	−0.273860597801
0.896635633289	0.40066746653	0.188441296907

K11n99

0.0	0.0	0.0
1.0	0.0	0.0
0.128357196705	0.490141636126	0.0
0.449584588148	−0.380144220299	−0.373383838823
0.265139691452	0.354364419904	0.279668331796
0.400242069719	0.135861027751	−0.686770292745
0.761152575078	0.382252247966	0.212693421767
−0.0700936168327	−0.098813143896	−0.0658848566168
0.622639217936	0.570262447575	−0.335067085842
0.154884909758	−0.219710625236	0.0613524538062
0.892001649351	0.393856471595	−0.221833580274

K11n103

0.0	0.0	0.0
1.0	0.0	0.0
0.131486509303	0.495665528837	0.0
0.839371904911	−0.210559008638	−0.0120486245087
0.140313354158	0.347250713294	0.435349919003
0.611540349823	0.0993205938327	−0.411099001145
−0.0507726876188	−0.00685427632026	0.330566919187
0.500918772102	−0.35434598726	−0.427645481199
0.552581690261	0.596048763681	−0.120919609658
0.105323796151	−0.23639716103	0.206180006038
0.566150286096	0.553453829332	0.610870454639

K11n105

0.0	0.0	0.0
1.0	0.0	0.0
0.148016619562	0.523568829723	0.0
0.689771247473	−0.314277903086	−0.0671920788424
0.0191131251301	−0.0908318538982	0.640119412679
0.479279663255	0.305073482695	−0.154553930052
−0.0484742674426	−0.446691828463	0.240825262082
0.48269382158	0.397744054457	0.171626267577
−0.15332414938	−0.368569778927	0.262424116558
0.737204693139	−0.0495508046248	−0.0618986773934
0.378123706771	−0.691155011591	0.615895455683

K11n108

0.0	0.0	0.0
1.0	0.0	0.0
0.153758192703	0.532799027386	0.0
0.744416774304	−0.180655637343	−0.376968011054
−0.251303379981	−0.107356705749	−0.433258693931
0.353131995709	0.402271942069	0.179061906685
0.365495441132	−0.233385342892	−0.592810467023
0.611743331864	0.0939357286	0.319452045891
0.685421283938	−0.0602504000665	−0.665838874145
−0.109840324945	0.106042699424	−0.0828246560525
0.614216043696	0.789022169479	0.0135154628634

K11n109

0.0	0.0	0.0
1.0	0.0	0.0
0.0664930490102	0.358559301168	0.0
0.91662150898	−0.158807065492	0.0980491927512
0.219793205851	0.530264746873	0.297072692272
0.518358808386	−0.32528764907	−0.125879644023
0.0742670540994	0.55174984196	0.057389974576
0.891002434966	0.101469645655	−0.303430011645
0.135883189401	0.20760843257	0.343508534811
0.373766033897	−0.0439432879745	−0.594645761766
0.685231025108	0.727256492844	−0.039451690009

K11n115

0.0	0.0	0.0
1.0	0.0	0.0
0.220054221017	0.625847091426	0.0
0.831038590263	−0.0182174002097	−0.460303194809
0.182964042853	−0.0961225806167	0.297278592106
0.548346497254	0.00219108714219	−0.628372575855
0.803852518126	0.400834147618	0.252422737276
0.853315951911	−0.340242596954	−0.417173131418
0.444157403939	0.418960573052	0.0889887293267
0.578977440821	−0.494789034228	−0.294267337618
0.912520901062	0.408333407854	−0.0238627985684

K11n117

0.0	0.0	0.0
1.0	0.0	0.0
0.0811696856961	0.394652826566	0.0
0.607392644234	−0.160415929626	0.644195679749
0.889179930134	0.131758553624	−0.269713504384
0.0248271751257	−0.0246440015907	0.208232680486
0.736652416672	0.5962738733	−0.120044364308
0.862136216171	−0.395147911442	−0.0834839922778
0.656006989752	0.197775417971	0.694945623972
0.546185902151	−0.680008643958	0.22864693285
0.850879600576	0.242363478832	0.466115703932

K11n119

0.0	0.0	0.0
1.0	0.0	0.0
0.15036682823	0.527374130412	0.0
0.434946495185	−0.40457827511	−0.22467560392
0.729672254624	0.538603072414	−0.378121595737
0.227057024818	−0.184897233885	−0.851328989543
0.636046721575	−0.165133790066	0.0609959713316
0.0149418887581	0.54602020755	−0.268380376219
0.618219485003	−0.195403034985	−0.562230197214
0.506763697907	−0.0596668179043	0.422225635668
0.84557900102	0.27714813883	−0.456273012763

K11n123

0.0	0.0	0.0
1.0	0.0	0.0
0.358826176702	0.767395679111	0.0
0.320496259639	−0.102150725585	−0.492361521181
0.726093554979	0.633773653577	0.0497695904234
-0.0820464875954	0.0702948392797	0.221237655749
0.35785871978	0.742676256962	−0.374066163893
0.477428722763	−0.130170650602	0.0990525213691
0.247873893561	0.537933210807	−0.608719907284
0.480673674358	0.569079581921	0.363305897737
0.796112527036	0.27515832513	−0.538973784528

K11n126

0.0	0.0	0.0
1.0	0.0	0.0
0.130866732457	0.494577964784	0.0
0.0302866290102	−0.485666079008	−0.17030929922
0.584705848382	0.321481158115	0.0325026008112
0.377655609075	−0.332564770981	−0.695064661395
0.442349005397	0.432820308634	−0.054751890654
0.434355665784	−0.553733568563	0.108488894415
0.519152006691	0.390995478588	−0.208207502848
0.829312644741	−0.39797278894	0.322197485288
0.376514087591	−0.794554530008	−0.476361460122

K11n127

0.0	0.0	0.0
1.0	0.0	0.0
0.111067116014	0.458037474197	0.0
0.570214232252	−0.134054132944	−0.662277475386
0.23721886173	0.471697723659	0.0603419067456
0.40265512678	−0.514446192686	0.0480529498429
0.879962505255	0.27372372558	−0.340490286354
0.460927421305	−0.138319718464	0.468601672968
0.249482783079	0.542623420148	−0.232545677411
0.342985792677	−0.443950013017	−0.0986425476139
0.881834669644	0.223612706335	0.415168607893

K11n129

0.0	0.0	0.0
1.0	0.0	0.0
0.343552808362	0.754371980252	0.0
0.412606553011	−0.0960832667511	−0.521495400933
−0.0188006787874	0.105513557774	0.357848968864
0.36223174092	0.839505917354	−0.204351628086
0.771655480391	−0.0111899081362	0.125328237923
−0.157957691703	0.240751335598	0.394298422098
0.481522954062	−0.206344885583	−0.231137004383
0.767933459654	0.525847067499	0.386814422614
0.858953815693	0.083197869472	−0.505248906008

K11n140

0.0	0.0	0.0
1.0	0.0	0.0
0.399980200317	0.799985149855	0.0
0.199649828938	−0.160463115964	0.193408559761
−0.0823451413314	0.46725768634	−0.532157034171
0.782435966436	0.570494219824	−0.04073475771
−0.0918313183041	0.341011133727	0.387043488614
0.591048525467	0.794697628692	−0.185532867218
0.408283846873	−0.163509009726	0.0345514583269
−0.0958212908236	0.648959659373	0.327421176599
0.782781223104	0.604428819476	−0.148051879229

K11n142

0.0	0.0	0.0
1.0	0.0	0.0
0.0324034985169	0.252501505575	0.0
0.869032789519	0.0189638201695	0.495491250106
−0.130049992543	0.0520407714507	0.468297319158
0.660060942412	0.25219676058	−0.11106637532
0.274741177246	−0.570121221738	0.307648103207
0.263741533065	0.411650562467	0.497393120448
0.75226831321	−0.0873412562222	−0.218392287312
0.183387072031	−0.437156692439	0.525921688117
0.87768933759	0.270612896463	0.395512435896

K11n153

0.0	0.0	0.0
1.0	0.0	0.0
0.212162731087	0.615883461145	0.0
−0.553553372407	0.141042836602	−0.433826267223
−0.169170450811	0.62316127228	0.353454866531
−0.381049782351	−0.264209124242	−0.0560337514326
0.273437762347	0.491392199811	−0.0827300606331
−0.646951319642	0.40439650102	0.298472885509
−0.1388367887	0.419614207496	−0.56268217884
−0.186236846864	0.245520730006	0.420905486587
−0.660468751519	0.661666900091	−0.354933714363

K11n144

0.0	0.0	0.0
1.0	0.0	0.0
0.247435619663	0.658518681169	0.0
0.602096429825	−0.275286319721	0.0471585628281
0.486465647739	0.450374183113	0.72542573501
0.108428645076	0.248275825803	−0.178036648595
0.652617966392	0.0651413374588	0.640693918651
0.233669949082	0.56311283771	−0.118586624844
0.743604467864	−0.219929800129	0.237518716146
−0.0535911737621	0.154587084353	−0.235996027247
0.617152601514	0.764554377024	0.18595502418

K11n154

0.0	0.0	0.0
1.0	0.0	0.0
0.052692364358	0.32032521514	0.0
0.394197905823	−0.527969905614	−0.40468426366
0.0899280497204	0.397110442	−0.631942278097
0.771053608773	0.220411288532	0.0785824448852
0.0216439501349	−0.321270990021	−0.302160871066
0.663360098298	0.432922636052	−0.162904418518
0.250461676265	−0.394404319683	0.217943321919
0.366249154575	0.353064223498	−0.436185133984
0.00527140420349	−0.463939849542	−0.885851019249

K11n150

0.0	0.0	0.0
1.0	0.0	0.0
0.409845832662	0.807290566508	0.0
0.529454296874	−0.184902810474	0.0353003960559
−0.0699371617761	0.614007414306	0.0850229466686
0.753126213097	0.0507387683618	0.0122554165569
−0.0484021726464	0.457302884297	0.450727612347
0.754506895159	0.550489207049	−0.138045126567
0.316090751103	−0.209677934346	0.341472549618
0.790222093981	0.140828709812	−0.466205952077
0.577289018959	0.764999195362	0.285505901315

K11n155

0.0	0.0	0.0
1.0	0.0	0.0
0.261829514969	0.674614211997	0.0
0.412891638113	−0.313900942714	−0.00424545140443
−0.054125411938	0.518037024135	0.295378136247
0.630536109057	0.208406199147	−0.364445593158
0.585766746992	−0.0823472822614	0.591304435494
0.0036551118795	0.0382414146278	−0.212812726646
0.0878430139561	0.239591832855	0.76308194299
0.0474317782519	0.0394357566812	−0.215848328889
0.443900323157	0.884682664299	0.142439764778

K11n158

0.0	0.0	0.0
1.0	0.0	0.0
0.213058192973	0.617027221728	0.0
0.12752430926	−0.27518372589	−0.443445125904
0.515054480245	0.545970059493	−0.0244859067342
0.403724382388	−0.325659595021	0.452868630987
0.319679600663	0.215863447972	−0.383605677389
0.14026423323	0.740773715445	0.448427577373
−0.0707686938838	0.456513803842	−0.486805765878
0.539094134103	0.202432497969	0.263867279492
0.635631657168	0.250228094823	−0.730313834572

K11n167

0.0	0.0	0.0
1.0	0.0	0.0
0.146184822161	0.520576259631	0.0
0.442962070174	−0.375059339956	−0.331300675842
0.678219970374	0.0905533718697	0.521845573624
0.511542292538	0.203897907246	−0.457629575632
0.608123531371	0.565072610558	0.469853522862
0.154890487976	0.209513368274	−0.347555452867
0.540228231434	−0.153890900663	0.500649805774
−0.0735306550562	0.439371405406	−0.0202531270759
0.924716535074	0.380265917346	−0.017238383512

K11n161

0.0	0.0	0.0
1.0	0.0	0.0
0.397711711807	0.798278659307	0.0
0.423495347876	−0.201236707199	−0.0174423688115
−0.172214630684	−0.763622601777	0.556013581566
0.310748366285	−0.0475985952332	0.0519735379069
0.0649156837951	0.829753862743	−0.360117418926
0.675448236364	0.224782322342	0.151018020619
0.222553549992	−0.00805559087889	−0.709605537752
0.340220983181	−0.259781149732	0.251013334739
0.828028268561	0.558055385006	−0.0542528683979

K11n168

0.0	0.0	0.0
1.0	0.0	0.0
0.15190258056	0.529840322305	0.0
0.485888863251	−0.412127475218	0.0339091640331
−0.0409178871127	0.431221215338	−0.0720985428049
0.916943026222	0.286896672248	0.176241741819
−0.0407257593535	0.233030384511	0.459029507076
0.716272278439	0.21561991284	−0.194155647573
−0.232795889852	0.52734362864	−0.239958889196
0.567134247301	0.108306756264	0.189598877889
0.225069086157	0.944605249535	−0.238882458558

K11n163

0.0	0.0	0.0
1.0	0.0	0.0
0.0292620198603	0.240141154146	0.0
0.652015728991	−0.207531297871	−0.641690886229
0.577050156281	0.0340551079013	0.325788401123
0.191462727379	0.171004819164	−0.586662754423
0.37175591241	0.24006096126	0.394523067259
0.613253516249	−0.32552968186	−0.394011099252
0.0405811289985	0.481382173682	−0.538716297037
0.524742437135	−0.127321770498	0.0898275248583
0.506386593546	0.859262804592	−0.072388193249

K11n169

0.0	0.0	0.0
1.0	0.0	0.0
0.07098759234	0.370048573046	0.0
−0.391614365197	−0.00822443464948	−0.801816039084
0.120356915961	−0.12681008022	0.0489617532536
0.585193233564	0.660890054799	0.453258296804
0.648303627142	−0.149357950713	−0.12942107282
0.312888278809	0.179630702784	0.753337676767
−0.0243372521963	−0.521746082889	0.125365109088
0.17832341267	0.444992241423	−0.0306658725241
0.738381695946	0.00985737611074	0.674310984063

K11n170

0.0	0.0	0.0
1.0	0.0	0.0
0.196959731071	0.595924765787	0.0
0.477098769964	−0.312606208769	−0.309989656537
0.355499860446	−0.148957016057	0.669006077329
0.994778878571	0.101311016277	−0.0581034391652
0.223702594605	−0.429511134691	0.293562891819
0.124567993401	0.386356906034	−0.276113920918
0.981349340008	0.0511468194657	0.115753304006
0.109277847426	−0.1299042209	−0.338902425759
0.273438031014	0.850285156395	−0.449718574232

K11n171

0.0	0.0	0.0
1.0	0.0	0.0
0.177730171508	0.569097820371	0.0
0.177085946732	−0.427286348778	0.084959828404
0.511857945264	0.446516733612	−0.267738175849
0.660422189536	−0.286902477257	0.395605570976
−0.192168498114	−0.12664494895	−0.101794312371
0.665489220451	0.365831157186	0.0461601491022
0.246089996914	−0.387506521221	−0.46038366301
0.386383843495	0.468381605835	0.0373845064996
0.707884468014	−0.13354483882	−0.693588751328

K11n175

0.0	0.0	0.0
1.0	0.0	0.0
0.38134893891	0.785665873392	0.0
0.302357920644	−0.203025756605	0.12747266298
0.327209625087	0.656983754433	0.637145139881
0.858819172944	0.31588760032	−0.138125588495
−0.0158379388341	0.736540676063	0.102760124414
0.423365226013	−0.160148223462	0.0475369638927
−0.00177379799186	0.557751231141	0.598787527021
0.313244803595	0.656084411003	−0.345190156185
0.681004054228	0.465780709795	0.565050270779

K11n178

0.0	0.0	0.0
1.0	0.0	0.0
0.0647354551548	0.353949475428	0.0
0.280479014578	−0.622225384325	0.0231810214112
0.682233661201	0.27090730539	0.22543631177
−0.167564809688	−0.112017985295	0.587666598505
0.586878861491	−0.100704443919	−0.0686006875907
−0.0423183714534	0.6761148485	−0.0943422683544
0.302356658992	0.0909559723988	0.639679674851
0.365456551685	0.00881082643204	−0.354941146637
0.854149876115	0.0688932697394	0.515443213669

K11n179

0.0	0.0	0.0
1.0	0.0	0.0
0.211625469523	0.615195578409	0.0
0.56867662399	−0.317835438594	0.0443575743658
0.605539827644	0.519790071704	0.589357215389
0.22900088777	0.0761928818194	−0.223932376261
0.792247418172	−0.0140075001661	0.59741848487
0.605466302562	0.502662730467	−0.23814401287
0.717479049736	−0.488355805268	−0.165100147285
0.392527681975	0.236811837891	0.441973569742
0.831188650516	0.323012882607	−0.452535197442

K11n180

0.0	0.0	0.0
1.0	0.0	0.0
0.271261736377	0.684792335771	0.0
0.260173897654	−0.212533836078	−0.441228740165
0.566166667977	0.71005007691	−0.2062663006
0.565678352792	−0.214977393329	0.173633608392
0.0753139448299	0.141895023562	−0.621466904415
0.7110725514	0.0307427376289	0.1423761184
0.276965006313	−0.28501020305	−0.701336344321
0.271507373102	0.27382267952	0.127925992698
0.816334374657	−0.564699576466	0.1212954125

K11n181

0.0	0.0	0.0
1.0	0.0	0.0
0.0771344475594	0.385122282033	0.0
0.767443123446	−0.232188985077	0.37736021451
0.350124684671	0.675769520825	0.339193839006
0.178721683003	−0.307426884363	0.402009759314
0.824055125801	0.424741621649	0.184124407791
0.38891315356	−0.388712658381	−0.201807708383
0.116246637931	0.180572040988	0.573800377134
0.80991471669	−0.0881457150556	−0.0944924958623
0.45589951696	−0.44989375016	0.767952631353

K11n185

0.0	0.0	0.0
1.0	0.0	0.0
0.183418671818	0.57723039981	0.0
0.902342504443	−0.0898823943798	−0.195215375195
0.487194595197	0.473386320942	0.519193868719
0.497271613701	0.378563664382	−0.476249307711
0.329546347029	0.00602040187009	0.436482718941
0.343202864229	−0.0140603778393	−0.563222368485
0.78933323676	0.395735843703	0.232412439399
0.342481205384	−0.385095254819	−0.204195001716
0.905387389326	0.423355304826	−0.0323103872531

K11n182

0.0	0.0	0.0
1.0	0.0	0.0
0.27180778434	0.685372962008	0.0
0.328773766245	−0.312961925382	0.00907356185416
0.705625840147	0.582198354322	−0.228982288811
-0.199983911905	0.382058505344	0.14493617535
0.779106268177	0.408650053499	−0.0567450306019
0.0384013788617	−0.232020785988	0.145485388414
0.41967761724	0.636221613122	0.462949664256
0.230574045461	0.543711978262	−0.514640130392
0.933330182693	0.320896239095	0.160998055298

K12n4

0.0	0.0	0.0
1.0	0.0	0.0
0.431325254951	0.822562480511	0.0
0.221057891085	−0.152175957039	0.075316758135
0.28759180347	0.401935825689	−0.754462351475
0.795024305304	0.288311219755	0.0997049067417
−0.131500112081	−0.0394200039316	−0.0850780714035
0.591900147526	0.563465030648	−0.421562394188
−0.00920570757845	−0.165980185782	−0.748030504708
0.282564823054	0.138761578226	0.158612983508
0.426089510078	0.466257711108	−0.775275097132

K11n183

0.0	0.0	0.0
1.0	0.0	0.0
0.268929433648	0.68230185916	0.0
0.160586856138	−0.311109115813	−0.0373700508666
0.563984027246	0.586465620572	0.140479084486
−0.00607738116926	−0.199298562024	−0.0995305819552
0.155626141239	0.12898793853	0.831103580536
0.347434507774	0.163768087164	−0.149712351119
−0.537858395092	−0.252597068602	0.0574024315431
0.388961829745	0.0871272519994	0.217376356995
0.67534586973	0.00791697111541	−0.737458661761

K12n35

0.0	0.0	0.0
1.0	0.0	0.0
0.159421872233	0.541690327696	0.0
0.167659476379	−0.33766295128	−0.47609867951
0.553233070583	0.475988759045	−0.0410080019067
−0.187239748898	−0.131258200624	0.247004382519
0.181902705241	0.447584545062	−0.48009597116
0.218488027925	0.0677368260007	0.444229309512
0.181442683668	−0.0722066236982	−0.545236947293
0.874255122217	0.191617339062	0.12588736434
0.601461046681	−0.0911844857748	−0.793681295533

K12n41

0.0	0.0	0.0
1.0	0.0	0.0
0.0448705598292	0.296188710992	0.0
0.910797026247	−0.0178581667157	0.389288984379
0.422301073908	0.0822436164959	−0.477516263382
0.560237865392	−0.485413711919	0.334110867173
0.596068402885	0.422850958712	−0.0827481745515
0.768967537745	−0.550554073132	0.0675466462029
0.192462842739	0.2621356323	0.152268422152
0.641890805893	−0.608466917801	−0.047895774678
0.868744565821	0.237565055533	0.434563831614

K12n119

0.0	0.0	0.0
1.0	0.0	0.0
0.136526649404	0.504394461518	0.0
0.61443790356	−0.242070309438	−0.463023950646
0.20981817891	0.0259022508119	0.411317850584
0.061375064025	0.373196548874	−0.51461482093
0.727686591632	0.164855049929	0.201361971986
−0.158337455803	0.058935474064	−0.250016395701
0.583294460144	0.630562875539	0.101016672731
0.61239846863	−0.366998174479	0.0375745086926
0.787119868464	0.604552954634	−0.122303056838

K12n45

0.0	0.0	0.0
1.0	0.0	0.0
0.0441127171741	0.293733727263	0.0
0.631184344463	−0.497381648251	−0.171707213179
0.279532441941	0.36492756912	0.1926603939
0.422441148725	−0.453801884331	−0.363450371664
0.100301343853	0.379301335862	0.0861772193728
0.441791013808	−0.526797265277	−0.163562906215
0.192064875938	0.383658093847	−0.493271709717
0.492579970904	−0.164310110969	0.287382838857
0.730798908353	−0.0687788937583	−0.679118855078

K12n152

0.0	0.0	0.0
1.0	0.0	0.0
0.142928246389	0.515197058573	0.0
0.550910186966	−0.388487251525	−0.13002078236
0.32741928646	0.566065086228	0.0671635270601
0.538754444687	−0.321058384601	−0.343140504605
0.379957985429	0.267824249659	0.4493245909
0.170915055046	−0.313250258871	−0.337220683571
0.421361625349	−0.211042946298	0.625499514971
0.26442857278	0.445966876195	−0.111867496876
0.96701075298	−0.231066400094	0.10723116324

K12n53

0.0	0.0	0.0
1.0	0.0	0.0
0.239650507629	0.649514164165	0.0
0.291524616266	−0.318499858152	0.245474905951
0.808575941597	0.159225727649	−0.464761809267
0.597270962321	0.0415234773525	0.505545557503
0.578224329981	−0.078563622514	−0.48703507612
0.701874039152	0.530067734007	0.296724211725
0.573695759291	−0.270081864494	−0.289220281032
0.191751960316	0.498002418627	0.224750018156
0.97104105074	0.0663248184644	−0.229521886174

K12n153

0.0	0.0	0.0
1.0	0.0	0.0
0.157064061201	0.538013943203	0.0
0.739722954638	−0.162426783381	0.412178847638
0.777354862359	0.452114511654	−0.375807723451
0.480169953242	−0.167543861797	0.350625088311
0.369561629843	−0.137333250232	−0.642779722299
0.488970983117	0.274028826771	0.260836705149
0.527065324399	−0.717607534931	0.137523496964
0.197229885781	0.200287235146	−0.0831069055104
0.826316157017	−0.471196531765	0.308505165444

K12n156

0.0	0.0	0.0
1.0	0.0	0.0
0.277817498279	0.69170256195	0.0
0.406956814348	−0.113945375128	0.578147419372
0.435047234049	0.713172190661	0.016820900593
0.696884553712	−0.239496953817	−0.13765472594
0.206937623645	0.436168568548	0.413188362067
0.762907218686	0.221614480234	−0.389846103306
0.478682276025	0.130027581347	0.564527000842
0.378060691408	0.481087049615	−0.366404009732
0.781024039986	0.322265851563	0.534926321918

K12n189

0.0	0.0	0.0
1.0	0.0	0.0
0.208897666559	0.611683821941	0.0
−0.108936851754	−0.324527144259	−0.149967482259
0.530048643101	0.411640373739	0.0730906330604
−0.20961854942	0.621246321816	−0.566407444215
0.240548930404	0.0993321527185	0.158130229204
−0.30049205852	−0.373969879456	−0.537038696052
0.107122055848	0.0773483122979	0.25678913387
0.078859512731	−0.149394015482	−0.716755495538
0.0207641885306	0.834894389478	−0.550018369596

K12n172

0.0	0.0	0.0
1.0	0.0	0.0
0.498866783296	0.865370151505	0.0
0.80180628897	−0.0818430537697	0.104951415686
0.195776083924	0.0363024261057	−0.681667320523
0.0172419714959	0.397181582283	0.233696981455
0.533306793405	−0.215629075129	−0.364751176493
0.83380823063	0.37767340994	0.382035973529
0.505238440876	0.529284409181	−0.550195756338
0.19101253327	−0.153964473815	0.108919592349
0.77777756617	0.601184030081	−0.183411612331

K12n199

0.0	0.0	0.0
1.0	0.0	0.0
0.0310265775484	0.247164938012	0.0
0.272732641634	−0.415078148777	0.709233581117
−0.106537446682	0.383840182053	0.242453439323
0.389093407608	−0.472893997066	0.0997768729014
0.549514582301	0.253549779736	0.768016714467
−0.0768041945478	−0.187626741166	0.12529743891
0.608473622137	0.431434048466	−0.258314412705
−0.17326564468	0.0328100432691	0.221250620628
0.686814915057	−0.0450228617869	0.725436568124

K12n176

0.0	0.0	0.0
1.0	0.0	0.0
0.059545183265	0.339918722168	0.0
0.520798671448	−0.140852162764	−0.745724195559
0.460828560619	0.418352390416	0.0811336238455
0.217720049611	−0.533432710335	−0.105958262307
0.582688956883	0.16526907643	−0.721274042941
0.382735594713	0.0424667372548	0.250805294587
0.371372287656	−0.208011912317	−0.717250138413
0.350702758522	0.370143080574	0.098414973481
0.875061683816	−0.387801929572	−0.289614766435

K12n200

0.0	0.0	0.0
1.0	0.0	0.0
0.241634459455	0.651829507551	0.0
0.68612525512	−0.243725731087	−0.0202174953399
−0.116270217095	0.32964802229	−0.185759167157
0.515903775068	−0.419189607542	0.0132339175962
0.306136964832	0.457475199593	−0.419728784324
0.915025891417	−0.0049441398103	0.224804092749
0.304495447228	−0.516600989459	−0.37972865651
0.354947172052	0.267354060678	0.239035517329
0.859712401297	−0.288167990929	−0.421727158314

K12n238

0.0	0.0	0.0
1.0	0.0	0.0
0.136695491102	0.504683390768	0.0
0.421762761569	−0.0658460558064	−0.770216074813
0.145004862313	0.0674943835767	0.181427446904
0.770805473849	−0.312830299016	−0.499547391407
0.433327728072	0.425314513317	0.0846195428944
0.0912536119726	−0.483314978719	−0.154916978951
0.780082774634	0.220822975943	0.0174318692384
−0.198405127264	0.199299849706	−0.187746543067
0.559665334707	0.828556733821	−0.0163845038617

K12n242

0.0	0.0	0.0
1.0	0.0	0.0
0.27539344994	0.689162787453	0.0
−0.29344479565	−0.133281583837	−0.00288209764301
0.508790107597	0.210193909252	0.485424922231
−0.228262642114	0.168406853324	−0.189117208477
−0.127300696481	−0.171928326383	0.745751044802
0.100393635268	0.222147972389	−0.144675348583
−0.78305333565	0.184603949209	0.322349164583
0.14802590696	0.0480776854263	−0.0159584222025
−0.221165201466	0.969761371978	0.10319319299

K12n253

0.0	0.0	0.0
1.0	0.0	0.0
0.0498392949107	0.311760540326	0.0
0.853930823712	−0.275336829854	0.0935600942588
0.37709649617	0.598452242254	−0.00194740043231
0.0157195545274	−0.203088549946	−0.478328618038
0.724885712268	−0.130494950581	0.222965564203
0.36433362631	0.467659917286	−0.492724974618
0.716246180287	0.560018346706	0.438740255473
0.606291772706	−0.290249408438	−0.0759973211774
0.72045376195	0.675338400299	0.157684564792

K12n254

0.0	0.0	0.0
1.0	0.0	0.0
0.0375215403461	0.271358093121	0.0
0.780366924208	−0.329158081866	0.295907180133
0.275933647887	0.187156017457	−0.396167108206
0.225851884113	0.134575929146	0.60119298286
0.484053254202	−0.294610821211	−0.264330434387
−0.00268988103536	0.469025957801	0.159862906013
0.120843951667	−0.0404673532708	−0.691697989139
0.18579100013	0.129449053763	0.29161798018
0.784354517363	0.422968190725	−0.453746515939

K12n280

0.0	0.0	0.0
1.0	0.0	0.0
0.316103607538	0.729579141957	0.0
0.396358067962	−0.215961160794	−0.315456427192
0.689071471198	0.416381292327	0.401803557435
−0.128314438762	−0.00840419265163	0.0126537585784
0.705106254694	0.543014302355	−0.0240557917273
0.263040850897	−0.318382878104	0.226090318104
0.854938849085	0.406403316825	−0.126530911235
0.177466073681	−0.15873083883	0.344270559342
0.934591051322	0.349519748968	−0.066147652041

K12n282

0.0	0.0	0.0
1.0	0.0	0.0
0.227198019292	0.63464722375	0.0
0.80305213029	−0.0485468470737	0.449041094375
0.308549219508	0.0352915146668	−0.416082018441
0.199720115504	0.348153376864	0.527461134417
0.57709432889	0.771341439061	−0.296250324218
0.593965345576	−0.00349036704474	0.335691952452
0.173717438265	0.85702998167	0.0477745583126
0.349131874749	−0.0290738097583	−0.381235751923
0.511052103872	0.858036077413	0.0509885966319

K12n284

0.0	0.0	0.0
1.0	0.0	0.0
0.186284717854	0.581263657561	0.0
0.538127170378	−0.347892957101	−0.113467502095
0.767628312041	0.600309769615	0.106170415906
−0.0841501893338	0.225816212554	−0.260200926198
0.449719889651	0.288415395388	0.58304523067
0.181127578722	0.603691424083	−0.327152108504
0.617475036796	−0.226783322116	0.0191318670967
0.0647554537766	0.599992035098	0.123743392515
0.536874097995	0.410338527957	−0.73714889634

K12n285

0.0	0.0	0.0
1.0	0.0	0.0
0.0819082148581	0.396367851944	0.0
0.305556892838	−0.210213863657	−0.762915389238
−0.190753654022	0.249725114046	−0.026619268194
0.778407712628	0.391516786536	−0.22816669935
−0.0234180077995	0.129507878812	0.308887158596
0.0363265825991	0.445828140084	−0.637882124929
0.620342829112	0.221326092737	0.14219726497
−0.190383330881	0.182032576432	−0.441908130553
0.333212991635	0.941228640041	−0.055296920099

K12n286

0.0	0.0	0.0
1.0	0.0	0.0
0.292015853621	0.706228326022	0.0
0.7027767968	−0.029573651755	0.538396598298
−0.0323999009949	−0.149437985569	−0.128797349891
0.261988030089	0.483917161024	0.586882050621
0.873157242278	0.138786923119	−0.125408138105
0.373198388809	0.170729425915	0.740051751984
0.704597775902	0.417525027198	−0.170588889225
0.232188628999	−0.316399600996	0.317452336546
0.811575130983	0.498552258169	0.304616894878

K12n287

0.0	0.0	0.0
1.0	0.0	0.0
0.305155192794	0.719159713763	0.0
0.181455745916	−0.258291677318	−0.1711351072
0.0596828515817	0.60352613143	0.321248307153
0.735579235675	0.426134651463	−0.394081225863
0.229450713248	0.00445942229873	0.358264386137
0.106838477035	0.373764960227	−0.56291944958
0.552055541135	0.707643208287	0.267927757376
0.0343841175049	0.159816558793	−0.389264953525
0.889321802423	0.455804280358	0.0367313182774

K12n293

0.0	0.0	0.0
1.0	0.0	0.0
0.0563101397619	0.330831449055	0.0
0.290434259428	−0.59157553396	−0.307166492763
0.465350667467	0.366681371025	−0.0810073579756
0.168154414821	0.0694256657258	0.826358848735
0.0777578481332	0.0320439849016	−0.168845185959
0.844236746935	0.367983252908	0.37856225453
0.158217501011	0.543641303511	−0.327498538518
0.584617987542	−0.112158801777	0.295485287106
0.671951237839	0.662744083375	−0.330532621564

K12n296

0.0	0.0	0.0
1.0	0.0	0.0
0.236458736903	0.645759041399	0.0
0.364070777491	0.0764804446609	0.812180427241
0.468237257371	0.639258084736	−0.0078382751689
−0.0912190449133	−0.18628336761	0.0662559641
0.813929033259	0.215296294588	−0.0731740595319
0.310832957898	0.145640588306	0.788244782576
0.693890675687	0.231513574692	−0.131479423396
0.0678130013732	0.926629000961	0.221849445914
0.799046265232	0.310620813885	0.514820139466

K12n299

0.0	0.0	0.0
1.0	0.0	0.0
0.303542816286	0.717598349534	0.0
0.220340813732	−0.271366788753	−0.122578065017
0.726592336741	0.507127526198	0.248442146076
0.828552003093	−0.258635711855	−0.386546743342
0.026410240545	−0.0116646857943	0.157120346947
0.558207837656	−0.138637049198	−0.680178485394
0.592884258702	−0.126148988092	0.319142080868
0.34681695609	0.677181199168	−0.223178389722
0.912162687085	0.125584789849	0.390112410529

K12n311

0.0	0.0	0.0
1.0	0.0	0.0
0.0603292890927	0.342080334224	0.0
0.796858235248	−0.142888169712	−0.471519524162
−0.0313584454133	0.0292574227044	0.0617937279579
0.808132971599	0.493947204753	−0.219840018638
0.167373230934	−0.27300697875	−0.254599695689
0.789641840183	0.500570704297	−0.374430185276
0.181423636969	−0.131462745212	0.105782617533
0.672607061627	0.415526760564	−0.572112155947
0.66873490895	0.622748930355	0.406174089883

K12n309

0.0	0.0	0.0
1.0	0.0	0.0
0.0746697195936	0.379162065828	0.0
0.107890772471	−0.464161881868	0.536377740858
0.760342988584	−0.156842637195	−0.156342251306
0.0127751013816	0.449815889602	0.114042078655
0.198051237693	−0.521116479099	0.265577845795
0.311518434925	0.411705754762	−0.0764278196074
−0.147197637295	0.219834522839	0.79119248643
0.27934696977	−0.235536377623	0.00972141134316
0.221318020799	0.0191041643151	0.975014545828

K12n313

0.0	0.0	0.0
1.0	0.0	0.0
0.500779527874	0.866474996875	0.0
0.557587658952	−0.131317042958	0.0344075789365
−0.310288676343	0.275803879928	−0.250273331531
0.41045574575	−0.251973963923	0.199146322648
0.394128822527	0.548921967446	−0.399434614816
−0.19948360443	0.442791778956	0.398287560915
−0.000439421547194	−0.0160392853772	−0.467654393065
0.60275289456	0.121275266252	0.318032404393
0.701310229944	0.245224944647	−0.669349451257

K12n310

0.0	0.0	0.0
1.0	0.0	0.0
0.335986387907	0.747720484509	0.0
0.107634232178	−0.210416926108	0.172707832337
−0.010987048843	0.514482159834	−0.505857055415
0.557154357094	0.00602843218346	0.141205653832
0.178039144589	0.927649269391	0.0582195822761
0.0598342957665	−0.00452608549647	−0.283945175487
0.00364262612204	0.894561155365	0.150202989984
0.609495341738	0.109116498387	0.0236360993452
0.23294396236	0.620412438931	−0.748882845323

K12n318

0.0	0.0	0.0
1.0	0.0	0.0
0.0761595532947	0.382777780221	0.0
0.869478866748	−0.212557140214	−0.127360902207
0.201425692823	0.353099396019	0.356103305181
0.380338464337	−0.629589783415	0.308017997525
0.386723909476	0.248108044696	−0.171153943035
0.10231070983	0.364060308363	0.780509970549
0.244588253491	−0.300820833164	0.0472363734438
0.370961132056	0.682624911313	−0.0826264897345
0.684470243602	0.161205888586	0.710994477552

K12n321

0.0	0.0	0.0
1.0	0.0	0.0
0.379484449635	0.784194141622	0.0
0.823178434661	−0.0937912927014	0.179658633989
0.460935358436	−0.0113866387963	−0.748775222967
0.600547971916	0.440500736135	0.132307133306
0.197203870593	−0.287848072714	−0.421607615166
0.967523668866	0.227491318902	−0.0460643821872
0.00340531642915	−0.00866216204198	0.0752094234438
0.71431331496	0.691450381277	0.00848428341134
0.951390851685	−0.266204891894	−0.154888356118

K12n347

0.0	0.0	0.0
1.0	0.0	0.0
0.0883173134184	0.410894973183	0.0
0.794885958907	−0.272244897858	−0.184609495437
0.429279196413	0.242915565283	0.590594601839
0.477068203685	0.157905829526	−0.404638815812
−0.157362091513	−0.105745495432	0.32198775911
0.285628265472	−0.590663063346	−0.432077553675
0.495884220737	0.380883212994	−0.323035056429
0.460901053896	−0.110296340736	0.547320516906
0.830956238046	0.545140248403	−0.111057822882

K12n323

0.0	0.0	0.0
1.0	0.0	0.0
0.174376971505	0.564222132514	0.0
0.264168598622	−0.403291984175	0.236334292283
0.236795391419	0.155649964405	−0.59242056028
0.631872027724	0.500208455177	0.259162611162
0.323162954455	−0.370379308098	−0.123950498138
0.0696068590267	0.122612232226	0.708316675095
0.00894229062766	−0.600924959424	0.0207021446778
0.672626889789	0.143749128057	−0.0498900381055
0.519668773224	−0.550723147511	0.653183267492

K12n349

0.0	0.0	0.0
1.0	0.0	0.0
0.199613572294	0.599484417099	0.0
0.426582384619	−0.0477574657707	−0.727710865173
0.480539853018	0.266101311725	0.220224396009
0.272031597269	−0.384256916105	−0.510226480353
0.615048727241	0.0275609812975	0.334015942133
0.380497473673	0.0653040710509	−0.637354825713
0.280369060298	−0.587758719629	0.113300416235
0.238275746217	0.12627266529	−0.585546730329
0.963101669482	0.253064058229	0.0916174474306

K12n328

0.0	0.0	0.0
1.0	0.0	0.0
0.418495306794	0.813543048511	0.0
0.19192161991	−0.158999130254	−0.0531608402401
0.59373320294	0.6487329036	0.378251275061
0.572589173715	0.0293516298934	−0.40655428545
−0.0979699797342	0.556407724369	0.115520704376
0.859649917523	0.355063820533	0.321493432585
0.171183799009	0.591168463673	−0.364268188641
0.402732701582	−0.0538148813733	0.364004830446
0.829045605545	0.315197467716	−0.461880872381

K12n352

0.0	0.0	0.0
1.0	0.0	0.0
0.0401661887069	0.280569162059	0.0
0.666279203557	−0.273752942745	−0.548369853986
0.475290828882	0.281858371665	0.260839332837
0.162076455382	−0.359388496952	−0.439659924637
0.391392233479	0.415138949031	0.149849625188
0.780623700276	−0.50411312726	0.0909048587488
0.531514105935	−0.0514176381603	−0.765255876251
0.319197346973	−0.547538376326	0.0766383017939
0.9571320432	0.151225781669	−0.247040512546

K12n356

0.0	0.0	0.0
1.0	0.0	0.0
0.286782562936	0.700942856065	0.0
0.419582556692	0.121695918452	0.804261864646
0.444466680468	0.640415561015	−0.0503203214558
0.866230067587	−0.266163069373	−0.0351271582006
0.434280318932	0.565062978843	0.314848085787
0.165883251676	−0.396763725486	0.2614401732
0.747818376141	0.304669457344	−0.150072889702
0.0233801400311	0.130158971664	0.516811907284
0.823977347537	0.558175995934	0.0974725002754

K12n370

0.0	0.0	0.0
1.0	0.0	0.0
0.100793587016	0.43752465856	0.0
0.336442843136	−0.348495515204	0.571525777656
−0.100861829813	0.420143720439	0.104665682501
0.770334661581	−0.0393623079792	−0.0681662683368
0.210087572397	0.0594208088319	0.754247918611
−0.0323684533644	0.177301984281	−0.208726174522
−0.00463622817002	−0.07291884318	0.759065363564
0.377531927079	0.131746130484	−0.142078215268
0.0968427081528	0.888855766998	0.447835812941

K12n363

0.0	0.0	0.0
1.0	0.0	0.0
0.0186752688896	0.192358446945	0.0
0.695637734488	−0.521744947997	0.178264302383
0.780028673796	0.454044410177	−0.0235110624101
0.357441453156	−0.450786004118	0.0284693408055
0.138778284994	0.250850101004	−0.649684915155
0.48964617867	0.107313505096	0.27567391623
0.128288716472	0.128384028491	−0.65651534436
0.434032691564	−0.174809771892	0.246033347459
0.382831151575	−0.698985298722	−0.604036308143

K12n374

0.0	0.0	0.0
1.0	0.0	0.0
0.14372840479	0.51652585147	0.0
0.589455803105	−0.373908310668	0.0919461216661
0.438503139815	0.607743986504	−0.0245530667553
0.689710310864	−0.358860866099	0.0261422598233
0.37321911555	0.399062743395	−0.544283130092
0.454899788489	−0.184946531901	0.263343908854
0.506427476158	−0.0567017789441	−0.727059130692
0.441322297055	0.241663620215	0.225169520546
0.796391327915	−0.461839674843	−0.390467626779

K12n368

0.0	0.0	0.0
1.0	0.0	0.0
0.27385718926	0.687543902897	0.0
0.833598159838	−0.0774710837506	0.318499789734
0.126384315496	0.62888821101	0.288414493059
0.740350428825	0.259587160206	−0.409197394425
0.316125366795	0.661826516022	0.402120420847
0.0403580158025	0.139390860522	−0.404733564698
0.819952940657	0.116356077608	0.221126764702
−0.0428545947231	0.621303467049	0.245443236231
0.834360305194	0.505233696064	−0.220412779752

K12n375

0.0	0.0	0.0
1.0	0.0	0.0
0.192808335394	0.590289434592	0.0
0.756617491665	−0.231957296296	0.0776501696643
0.0940255582316	0.315742755003	0.588528416956
0.804073544213	−0.0885739605672	0.0120218245271
−0.154966736921	−0.0883800543649	−0.271247837743
0.427680805554	0.189077518325	0.492649496069
0.299136028948	−0.0238791366116	−0.475919398499
0.632629079757	−0.0362703937091	0.466751722205
0.529029101437	0.848512921495	0.0124109584279

K12n377

0.0	0.0	0.0
1.0	0.0	0.0
0.0835619153733	0.400176507364	0.0
0.440286358133	-0.439744652981	0.408998919734
-0.0588399566526	0.185758989709	-0.190682758217
0.774782145499	0.42081891527	0.309138231938
-0.0312273559216	-0.160062846657	0.422826675857
0.543051336996	0.279175494839	-0.268023280516
0.485239335296	0.282977567848	0.73029696705
0.702831662548	0.0623218454751	-0.220473579036
0.333287901699	0.938662278101	0.0885002952038

K12n390

0.0	0.0	0.0
1.0	0.0	0.0
0.0308833249776	0.246602656501	0.0
0.0689123790497	-0.703527788618	0.309525327402
0.34243161534	-0.249081973559	-0.538216513345
-0.0409019943636	0.17965101479	0.279856446954
0.758943028072	-0.0764088121254	-0.262989115913
0.148243616308	0.0573352022439	0.517497121692
0.38777107478	0.924587700916	0.0810344082961
0.0615824629727	-0.0158379338169	-0.0148854283623
0.361892045371	0.6097933463	0.70511433279

K12n382

0.0	0.0	0.0
1.0	0.0	0.0
0.0421611936349	0.287306145115	0.0
0.305315833826	-0.652277667783	-0.218933537599
-0.210156743612	0.1497342062	-0.520703277466
0.516915331853	-0.076971037386	0.127348363693
-0.00453138268281	0.449873782157	-0.543865357875
0.0844266410066	-0.459242821449	-0.136933580953
0.226485931747	0.524790617827	-0.244159269574
-0.328408954317	-0.228003591417	-0.598267365992
0.258899651506	0.558850365455	-0.787818024344

K12n393

0.0	0.0	0.0
1.0	0.0	0.0
0.134781345997	0.501394735478	0.0
0.0240162018573	-0.492325461453	0.0158509638024
-0.450040290009	0.300487072925	0.398889771043
0.318126102663	-0.0778294281953	-0.117634205313
-0.061965909856	-0.0535413926358	0.806995533203
0.0663207036239	0.497396803531	-0.017631442348
0.430783202903	-0.429036373872	0.0766482183769
-0.232975164381	0.31755149823	0.121719041425
0.0455665017392	-0.0806602397188	0.995699562944

K12n385

0.0	0.0	0.0
1.0	0.0	0.0
0.289118307352	0.70331160879	0.0
0.201933957387	-0.0666073696548	0.632157935766
0.644426631278	0.463038736821	-0.0914961497248
0.26573033994	0.282333257479	0.816212310444
0.0412540427935	0.0799729449706	-0.137024646425
0.899435035168	-0.0794048989725	0.350954950676
0.55056244343	0.814944557161	0.070906802945
-0.0128084623162	-0.00219881117033	0.192931137199
0.788341189095	0.59512607059	0.156022849867

K12n394

0.0	0.0	0.0
1.0	0.0	0.0
0.199431540213	0.599241304646	0.0
0.583894341379	-0.249100038381	-0.36401280229
0.612864735642	0.708208471011	-0.0763999825089
0.110557932279	-0.151540837191	0.015898459202
0.287409140533	0.654087184512	-0.549510367035
0.562766062812	-0.0782187396883	0.0733111152004
0.323209026907	0.111720607534	-0.878810447902
0.109809859488	0.339283576265	0.0712821215913
0.983835838653	-0.0911348634603	-0.154147589162

K12n395

0.0	0.0	0.0
1.0	0.0	0.0
0.27805562175	0.691951092718	0.0
-0.0283123500898	-0.137768543377	-0.466587603038
0.653952157481	0.336977000994	0.0894086287913
0.678360306741	-0.560074478521	-0.351842870185
0.348714454205	-0.0617143497312	0.450011726321
0.203700080421	0.101939624187	-0.525789589632
0.791270051409	-0.597570563001	-0.119037789129
-0.00118803637233	0.0054926658566	-0.0277967834917
0.948842148693	0.315665125491	0.00735563818605

K12n396

0.0	0.0	0.0
1.0	0.0	0.0
0.204826034983	0.606381369569	0.0
0.123738987829	-0.338536794852	-0.317103379566
0.726749489855	0.427662677884	-0.0950297376694
-0.0133118994762	-0.0606798317449	0.367388615459
-0.102584701073	0.510861067481	-0.448314374242
0.551003711903	0.336709127205	0.288227062557
0.279704207857	-0.293448076434	-0.439301959411
0.0985223561877	0.299806471258	0.345059040555
0.93070403994	0.299871962252	-0.20944401709

K12n401

0.0	0.0	0.0
1.0	0.0	0.0
0.408490501051	0.806298029672	0.0
0.779119727421	-0.121779733541	-0.036133668377
0.240529829623	0.672095963142	0.24614686621
0.960017770608	-0.0220156076539	0.222775300901
0.00115422090566	0.0816138351054	-0.0415003726794
0.768891421601	0.0653168195407	0.599057195344
0.612915433438	0.512445396673	-0.281708112004
0.354692452808	-0.0909276215636	0.472786349963
0.725010533932	0.687926162092	-0.0334263548134

K12n403

0.0	0.0	0.0
1.0	0.0	0.0
0.105974398493	0.448015874551	0.0
0.42434721715	-0.450702790772	0.301568415025
0.41491409371	0.447578331641	-0.137751560958
-0.14663401495	0.292096313516	0.674953221666
0.775830766467	0.145138829854	0.317934699681
-0.0854765302732	-0.195232777346	-0.0592879263562
0.193291446487	0.491746462742	0.611791755068
0.214684607367	0.32254422154	-0.373557388251
0.455959831953	0.731946214252	0.506315485728

K12n406

0.0	0.0	0.0
1.0	0.0	0.0
0.197805081683	0.597062235471	0.0
0.35289058499	-0.352526669365	-0.272450726693
-0.187831980607	0.33222598082	0.216152297365
0.400880187858	-0.239922999757	-0.354867427974
0.330806538728	0.574062143623	0.221776196853
0.540286642213	-0.337772190435	0.574871415564
0.135581222599	-0.0143905971685	-0.280486911964
0.644773309186	0.135897072538	0.566942751956
0.540538918531	0.828393297157	-0.146908892781

K12n409

0.0	0.0	0.0
1.0	0.0	0.0
0.399246806874	0.79943455076	0.0
0.736914597859	-0.125053310368	-0.176925570673
-0.145353949962	0.312952701	-0.349415986439
0.684014095746	0.440912445821	0.194435968107
0.494719738158	-0.239283805655	-0.51373117718
-0.0683271539544	0.360045723994	0.0552875502566
0.917370807765	0.396062833319	-0.10934019983
0.0407691866515	0.432994939115	0.370457275594
0.778142278882	0.555081110457	-0.293903988796

K12n411

0.0	0.0	0.0
1.0	0.0	0.0
0.0865418989867	0.4069327926	0.0
0.220298097117	−0.575989071442	0.126387850092
0.626840697283	0.241252293374	−0.282072265323
−0.11701625842	0.242786538535	0.386264831914
−0.0032280924253	−0.60297124045	−0.135027823478
0.117601059658	0.356048588269	0.121255777501
0.602243408155	−0.233950251144	−0.524517529113
−0.108764095671	−0.14594956303	0.173138695969
0.814648122556	−0.520960289155	0.254850571003

K12n430

0.0	0.0	0.0
1.0	0.0	0.0
0.0983585604348	0.432484351692	0.0
0.804871107881	−0.0446814301789	0.522640255732
0.403828779464	0.567700433402	−0.158647865385
0.906317142742	−0.258052177647	0.0975514127485
0.458224265215	0.631023501441	0.191131378359
0.921027675312	−0.123505013869	−0.274163929147
0.536099240124	0.202256774548	0.589380717638
0.418050103471	−0.0192584502451	−0.37860451289
0.752815651075	0.53501644981	0.383439687473

K12n425

0.0	0.0	0.0
1.0	0.0	0.0
0.213579932862	0.617692057585	0.0
0.792073020802	−0.126074627033	−0.334898292111
−0.057503869358	0.127166734435	0.127798066799
0.77790977613	−0.339629048009	−0.162349720415
0.504703668589	0.57102365207	−0.472301462854
−0.03057590066	−0.175545509983	−0.0771935421326
0.771479891134	0.383584374146	0.132759499104
0.444509322996	0.0108018851518	−0.735643324171
0.732058464018	0.679413417989	−0.0498779782589

K12n432

0.0	0.0	0.0
1.0	0.0	0.0
0.145002026132	0.518631337929	0.0
0.13656237917	−0.310785180859	0.55856692591
0.214511360912	0.251385465078	−0.264772688764
0.212291060987	0.679967143961	0.638727623795
0.44944994451	−0.013067747743	−0.0420500953227
−0.227575089789	−0.134896487826	0.683756256966
0.681114188589	0.015937102833	0.294483828853
−0.0553693331292	0.557778831396	−0.11048476675
0.873994856013	0.42574133685	0.234259056943

K12n426

0.0	0.0	0.0
1.0	0.0	0.0
0.19507200183	0.593372494949	0.0
0.0392071444105	−0.369183679959	0.221792146771
0.629479855019	0.334142967213	−0.174326212422
0.128296370185	0.618092158648	0.643101442611
0.168788837792	−0.148460171761	0.00219748349402
0.715596255969	0.687281956684	−0.04816859803
0.483978181125	−0.207511195403	0.333535845726
0.0395986234269	0.31458189506	−0.394437789504
0.93212330327	0.358022124101	0.0544638059171

K12n435

0.0	0.0	0.0
1.0	0.0	0.0
0.196364447607	0.595121751351	0.0
0.60549513902	0.00826167966865	−0.698718350703
0.471210599263	0.297632436157	0.249032791566
0.0267220993073	0.518094871572	−0.619198910216
0.56805285899	0.478681079912	0.220686535335
−0.176156779807	0.361067145375	−0.436823142102
0.807603222057	0.184391555369	−0.405168843359
−0.155196327078	0.239017266506	−0.140531242347
0.726007167397	0.687634056655	0.00854382907926

K12n436

0.0	0.0	0.0
1.0	0.0	0.0
0.017248272412	0.184929829727	0.0
0.999501709992	0.043501632266	0.123191920698
0.0542198765665	−0.28142231723	0.0937524499239
0.828663572883	0.336449345388	0.229662603218
0.815230566152	−0.489201822978	−0.334358409251
0.437930759319	0.0329400472171	0.430502835128
0.727332253516	0.134806252144	−0.521269223429
0.589497831737	0.0096865858072	0.461251382598
0.434169737607	0.900202856518	0.03363712328

K12n439

0.0	0.0	0.0
1.0	0.0	0.0
0.219082504939	0.624634185669	0.0
0.708538229495	−0.193919053728	0.300672060509
−0.185478331962	−0.0517969079826	−0.124222848297
0.732235276502	0.308878245819	0.0422558778814
0.0911627981846	−0.420589464161	0.280799244252
0.55511665821	0.262914946663	−0.282732951945
0.676682551557	0.0223336997752	0.680253235506
0.309111084946	−0.0929916428118	−0.242563800688
0.763527617893	0.44785710891	0.465241428414

K12n442

0.0	0.0	0.0
1.0	0.0	0.0
0.0990734602664	0.4339716235	0.0
0.445205527902	−0.50372201286	−0.0303848002057
−0.123632038877	0.225297042263	−0.411114415404
0.499805068121	0.341428222608	0.362086543319
0.510969012158	0.155933392904	−0.62049527745
0.213405451024	−0.344107223441	0.192779159066
0.584025998341	0.447937496538	−0.292303897183
0.351256212379	−0.177862757924	0.452137012668
0.87500409191	−0.2822606788	−0.393315075155

K12n451

0.0	0.0	0.0
1.0	0.0	0.0
0.254138076294	0.666100586072	0.0
0.546557775201	−0.279000582735	−0.145857808874
−0.276816616631	0.108873687216	0.268398345678
0.671783147514	0.293127693955	0.0110873500644
−0.101217724812	−0.121128145105	−0.469393400005
0.653680009158	−0.128324068702	0.186409642021
0.19061932544	0.476833879323	−0.461169435109
0.248187960503	−0.0406341104264	0.392594426765
0.637352401205	0.769170690344	−0.0464582155711

K12n452

0.0	0.0	0.0
1.0	0.0	0.0
0.162693616921	0.546733958023	0.0
0.521263282831	−0.106637847677	−0.666733138674
−0.0516917736223	−0.126949112339	0.152601930643
0.380986847687	0.344973418518	−0.615563634539
−0.17596705991	−0.324926509443	−0.124609022248
0.42517279551	0.466542886613	−0.235094629145
−0.301470587308	−0.0921322176233	−0.634933999533
0.355454735711	0.00659108289472	0.112530267111
0.465994937037	0.186055914169	−0.865003997365

K12n454

0.0	0.0	0.0
1.0	0.0	0.0
0.457697566	0.840183355035	0.0
−0.200422017996	0.169845569511	−0.342820458052
0.466814484197	−0.21651474053	0.293984976101
−0.142542057676	0.306067702866	−0.302330539991
0.775653044006	0.475194364717	0.0558787947554
0.101274686065	0.0966868078223	−0.578113208124
0.248218107939	−0.752443991615	−0.0707824321855
0.14001894114	0.238245215691	0.0118482814231
0.222343658872	0.0782192999906	−0.97182562143

K12n464

0.0	0.0	0.0
1.0	0.0	0.0
0.0986688983639	0.433130748416	0.0
0.0851523739893	−0.565637116446	0.0477499286702
0.401539831858	0.192731751425	0.617640827657
0.340383652415	0.0558332667934	−0.371054639421
−0.082473657871	−0.0892634043711	0.523450056573
0.76438132028	0.383691333751	0.28024137731
0.0740350787593	−0.275216901377	0.579008852947
0.633469139369	0.0617840647614	−0.178265126965
0.560276180262	0.144369022269	0.81562748068

K12n483

0.0	0.0	0.0
1.0	0.0	0.0
0.0600947334228	0.341435337744	0.0
0.953976896846	−0.0288716991146	0.252680383819
0.244581624196	0.244954011878	−0.39676386101
−0.0796622292709	−0.11663569075	0.47737503553
0.350806367147	−0.139848769919	−0.424931974558
0.68842799962	0.531672912958	0.234666587229
0.0602781997617	0.532866829555	−0.543424926348
0.471033190886	−0.199753903001	−0.000702898514622
0.610602940898	0.784212474946	0.110339669686

K12n465

0.0	0.0	0.0
1.0	0.0	0.0
0.0301646110351	0.243760780913	0.0
0.496788854919	−0.623234831049	0.174872593218
0.398486714572	0.135870566073	0.818375262415
0.869792162831	0.0354197046549	−0.0578557567131
0.388580931197	−0.271997839565	0.763076764299
0.561826471852	0.0435042124215	−0.169899354278
−0.0920671055549	0.304979439894	0.54006817656
0.377176408733	−0.339591650773	−0.0635365230372
0.701677805457	0.270838111032	0.659010603056

K12n487

0.0	0.0	0.0
1.0	0.0	0.0
0.163791711315	0.548411978292	0.0
0.225305894818	−0.409907744801	0.278996977689
0.463438752061	0.469695547409	−0.132817046641
0.562765865961	−0.0701269050944	0.703081179351
0.0269759227353	0.468179401634	0.0525771771542
0.896379024699	0.158304425188	−0.332280907429
0.232874361065	0.240195467445	0.411396051024
0.247213468777	−0.115049052978	−0.523267375403
0.772447857745	0.626264703873	−0.105436368238

K12n477

0.0	0.0	0.0
1.0	0.0	0.0
0.0706001857354	0.369074498232	0.0
−0.18179723479	−0.293387173549	0.705294318376
0.287760091816	0.53927793176	0.411721943261
0.736285048858	−0.0862918000734	−0.226625825218
0.170873520079	0.112249279385	0.573931007799
−0.113937575857	0.401900264953	−0.339844099211
−0.18362645871	−0.0133468907795	0.567191324167
0.471307504449	0.304289645758	−0.118497041315
0.17194385415	0.583096703545	0.79399845424

K12n490

0.0	0.0	0.0
1.0	0.0	0.0
0.0648977528458	0.3543780289	0.0
0.622047388601	−0.468018265894	−0.115102639787
0.657345816428	0.52892621103	−0.0454195649167
0.320397544115	0.00227909503232	0.735034582998
0.297875293293	−0.110814720365	−0.258294434567
0.507958946346	0.627475278556	0.382636713227
0.445192780835	−0.28869039301	0.778491321272
0.22630326192	0.370190995	0.0587950693412
0.943341582186	−0.293009091802	−0.155731600646

K12n492

0.0	0.0	0.0
1.0	0.0	0.0
0.132076137605	0.496697261	0.0
-0.00321388977666	-0.4938445209	-0.0228820191642
0.720871419662	0.137360981966	0.25511092644
-0.122532202117	-0.184811881056	-0.174859976183
0.657963511083	-0.225803894239	0.448955779094
0.258783575247	-0.424202721306	-0.446194087824
0.0784462342851	-0.492211279352	0.535056787073
0.505107119797	0.159088457449	-0.0924534850475
0.47768933005	-0.808351254912	-0.344065622576

K12n526

0.0	0.0	0.0
1.0	0.0	0.0
0.155176387489	0.535044917501	0.0
-0.00762945393693	-0.444105322863	0.121486891441
0.689088227541	0.260339574008	-0.0139452302568
0.0149162966811	-0.459538831745	-0.179073327718
0.60512012415	-0.219349419343	0.591620183485
0.858074809131	0.120298027329	-0.314279115176
-0.00975445966402	-0.0866706531545	0.137424687688
0.577792295404	-0.590743096325	-0.495583829352
0.0884910927491	-0.950128776846	0.299039518982

K12n502

0.0	0.0	0.0
1.0	0.0	0.0
0.0579068570097	0.335351323138	0.0
0.355474303484	-0.372052338634	0.641119079509
0.555652280132	0.150069547517	-0.187927067378
0.213784749364	0.835837742976	0.454605868356
0.111721945387	0.0785576918272	-0.1904601036
-0.329905880542	-0.00558953740668	0.702783484218
0.639255919815	0.219488839448	0.602458367717
0.00142860101221	0.0497104290892	-0.148775019963
0.728411015429	0.669002023502	0.147829919676

K12n530

0.0	0.0	0.0
1.0	0.0	0.0
0.209394087541	0.612325314833	0.0
0.202291508841	-0.382099661055	0.105207037344
-0.00726985498782	0.573979136022	-0.0997255578418
-0.468961705785	-0.180790914332	0.366281744672
0.417960380298	-0.0164065376701	-0.0653975227584
-0.513472063225	0.240546217082	0.192301691401
0.229513527638	0.906899422988	0.129485954928
0.259303463712	-0.0721991589275	-0.0717068048819
0.490499279863	0.567220764119	0.661567125246

K12n521

0.0	0.0	0.0
1.0	0.0	0.0
0.267457675336	0.680721486789	0.0
0.823415896887	-0.122043810371	0.215588342834
-0.0348296109922	0.0620733509349	-0.263489436987
0.726104536369	0.138169857209	0.380861822119
0.586652827533	-0.359927116651	-0.474972639406
0.189611569814	0.277040201637	0.185807865075
0.511361212883	-0.491382824142	-0.367367713414
0.528266737931	0.316645286228	0.221533616245
0.583025341491	0.245620064233	-0.774436721254

K12n535

0.0	0.0	0.0
1.0	0.0	0.0
0.354052603943	0.763381923762	0.0
0.754409620791	-0.0692336836119	0.382708125622
-0.0220431517082	0.342558319608	-0.0943122493746
0.229560390566	-0.144740800388	0.741890611878
0.970339794016	0.147545236102	0.137064398576
0.0336515416203	-0.14799602874	0.324868761142
0.489657916091	0.733312372634	0.448778761181
0.880221227892	-0.0270227585311	-0.0702114003738
0.510521823486	-0.0425835771913	0.858809703425

K12n536

0.0	0.0	0.0
1.0	0.0	0.0
0.0498261340026	0.311720426626	0.0
0.303751190512	−0.653506541525	−0.062120573337
0.908400075851	0.139439424779	−0.137196667941
0.566565506355	−0.703610084367	0.278034174154
0.61143437166	0.0651636890977	−0.359910706035
0.741754807751	0.156604830931	0.627335515289
0.821701913671	−0.205535775325	−0.301353152433
0.214472020962	0.0890149851996	0.436557212635
0.974274410887	0.072494073288	−0.213386929375

K12n552

0.0	0.0	0.0
1.0	0.0	0.0
0.106808953283	0.449677388875	0.0
0.559186604059	−0.418969648796	0.202006893506
0.279779016223	−0.0100912874504	−0.66675652969
0.72669073442	0.101206188766	0.220871088135
0.323877674912	−0.704946864997	−0.212555829577
0.603408807317	0.23464683141	−0.0150057557004
−0.217060330147	−0.326718693051	−0.123168329707
0.494122464091	0.266428413723	0.254185009891
0.722727974511	0.030996025843	−0.690437195725

K12n548

0.0	0.0	0.0
1.0	0.0	0.0
0.417731865366	0.812996813887	0.0
0.583627844484	−0.116840114519	−0.328453665964
0.685344675044	0.674904822589	0.273869869144
0.403610099109	0.256793252752	−0.589732090031
−0.0533334385853	−0.0691806165496	0.237881128744
0.707154279173	0.550552946127	0.044002964859
0.176287293687	−0.135155683871	−0.453976872552
0.356783570131	−0.0538479481833	0.526232363432
0.741189641384	0.669635582862	−0.0471815818907

K12n562

0.0	0.0	0.0
1.0	0.0	0.0
0.0422810296502	0.287705359408	0.0
0.577736358345	−0.509900760158	0.277690599414
0.116881869805	−0.529854740283	−0.609560762416
0.128805490433	0.0440576590875	0.209269125362
0.262787530396	−0.354194288028	−0.698169136772
0.153879802429	−0.411696209714	0.294218204839
0.996162784938	0.0603675046002	0.0339967087954
0.0625210296912	−0.212041648684	−0.198610956742
0.863868816517	−0.318819091093	0.389980839277

K12n550

0.0	0.0	0.0
1.0	0.0	0.0
0.432001770974	0.823029775782	0.0
0.825739390785	−0.0959504497124	−0.0211194672377
−0.0602466254577	0.313454137605	0.196634207601
0.586077684297	−0.389193139381	−0.100942153631
−0.223189075333	0.106380467261	0.214484719286
0.736022974894	0.246678521639	−0.0309306401302
0.460286867499	−0.599179163444	0.425681203412
0.0880148039448	0.179690954655	−0.0790710623855
0.43106670456	0.293170555147	0.853365409315

K12n563

0.0	0.0	0.0
1.0	0.0	0.0
0.111224613925	0.458343008137	0.0
0.167739741756	−0.22475187987	−0.728139694225
0.608201368044	−0.0284528000374	0.147908379242
−0.0670088451971	0.670650552819	−0.0873482252564
0.34260888901	−0.230237065575	−0.230926812964
−0.401867366449	0.434589199951	−0.292254960862
0.527516737162	0.363885316452	0.0700241426119
−0.0248909751217	−0.377045287654	−0.311901974992
0.372175826198	0.363536226649	−0.85400618634

K12n566

0.0	0.0	0.0
1.0	0.0	0.0
0.410633050704	0.807865458525	0.0
0.562212207369	−0.157640994426	−0.211709821631
0.180449227846	0.449262359689	0.485373635517
0.111653229536	−0.331820041379	−0.135252977962
0.842528366976	0.332533121871	0.0211324687779
0.161135803301	−0.278769806907	−0.381375796274
0.763324100332	0.515959838652	−0.305388656651
0.221914454042	−0.14516684457	0.214021685599
0.857982969578	0.250201939249	−0.448624802602

K12n591

0.0	0.0	0.0
1.0	0.0	0.0
0.131059111071	0.494915883305	0.0
0.458533884278	−0.407971060252	−0.278487773642
0.541202331793	0.382775735864	0.328047824833
−0.10732645674	0.347107138261	−0.432306146412
0.502214758583	−0.196838722382	0.144393435269
0.154963812343	0.640269432929	−0.27829642343
−0.546736421983	0.135328970524	0.224348491569
0.403441221324	0.251637959535	−0.0648480942269
0.654856294658	−0.678238415633	−0.333400487263

K12n567

0.0	0.0	0.0
1.0	0.0	0.0
0.343771556789	0.754562277298	0.0
0.163081447107	−0.214076706946	0.170556742656
0.280213013587	0.527994204396	−0.489451559317
0.255475483456	0.00563776460002	0.362916790874
0.139167021141	0.226572419636	−0.605411779291
0.732956385943	−0.263859462247	0.0324681149527
0.113748359532	0.468007103926	0.316990081323
0.477735700135	−0.148101880907	−0.381524725027
0.852036937657	0.290357513279	0.435574989353

K12n593

0.0	0.0	0.0
1.0	0.0	0.0
0.0880731993488	0.410352909401	0.0
0.745871361822	−0.337495279802	0.0895804853278
−0.0493952734264	0.235187855852	−0.109379322165
0.496240056175	−0.374632381371	0.465426180038
0.569000455414	0.284995967746	−0.282635558954
0.698267733753	−0.53976129519	0.26787822651
0.278253177749	0.299408883015	0.613394050684
0.381038032107	−0.318889254359	−0.165799562633
0.81101049252	0.268671974851	0.519689667929

K12n579

0.0	0.0	0.0
1.0	0.0	0.0
0.29813345898	0.712308471518	0.0
0.776636690097	−0.117764209665	0.286380868364
0.273044150656	0.27549265851	−0.482867849446
0.129090992108	−0.193683488427	0.388425001028
0.360698638171	0.600529271035	−0.173343626604
0.474444367961	−0.380867321788	−0.0186741837573
0.695596453922	0.541336586768	0.298550824587
0.103459165327	−0.131329508209	−0.145176294399
0.918809682354	0.122334795417	0.375263861094

K12n599

0.0	0.0	0.0
1.0	0.0	0.0
0.309314181574	0.723154962802	0.0
0.631840357769	−0.22340542776	0.000541005838268
0.213554057525	0.68097189144	−0.0839470734623
0.141361510463	0.0211178620461	0.663970633268
0.565695700247	−0.297347803676	−0.183685025084
0.56437273939	0.698869355615	−0.0967964682475
−0.211832016184	0.262085549722	0.357874934343
0.608542578558	0.246502506555	−0.213739177683
0.188793775266	0.879602875886	0.436641375907

K12n614

0.0	0.0	0.0
1.0	0.0	0.0
0.012763547626	0.159261379826	0.0
0.646209320079	−0.530452921543	−0.350771486653
−0.118150228241	0.105252947273	−0.458625690295
0.612103322401	−0.0247596224567	0.212065358913
0.358005341486	0.322938025898	−0.690453649986
0.578317095316	−0.208264476905	0.127645752373
0.399237251639	0.715104115037	−0.211943489219
−0.101670635711	−0.121876808905	−0.432293713518
0.813253537227	0.273464835924	−0.513649362602

K12n638

0.0	0.0	0.0
1.0	0.0	0.0
0.0483197090587	0.307090579201	0.0
0.420290479035	0.113679177576	−0.907871012867
−0.131650568067	0.463042210964	−0.15070091875
0.506397031357	−0.269059752493	−0.389284187172
0.24919265412	0.394692370574	0.313054069976
0.033317279631	0.0315271376653	−0.593317176421
0.636756867123	0.656173080274	−0.0976579077393
−0.111429349871	−0.00700256622899	−0.11804041461
0.36245203941	0.786140639929	−0.500611040009

K12n617

0.0	0.0	0.0
1.0	0.0	0.0
0.354645301913	0.763883049725	0.0
0.245575999738	−0.227075768705	0.0781313477428
0.0305656439457	0.682268532231	0.434310360683
0.518593756223	0.0839123082857	−0.201140967818
0.0534243271636	0.419432759161	0.618031437304
0.209060702966	0.362746156039	−0.368155131026
0.893034988337	−0.134612602853	0.165524025306
−0.0563050178762	0.150332110628	0.0330096379304
0.90343224846	0.428706554028	−0.0045676007643

K12n639

0.0	0.0	0.0
1.0	0.0	0.0
0.0923241356056	0.41967192567	0.0
0.745331493583	−0.0979559347482	0.55284969797
0.477676004493	0.698445937396	0.0105355849283
−0.0820863058027	−0.12694836942	0.0839548892552
0.626899207974	0.547305312771	−0.122736942481
0.298260768562	0.0818250924043	0.699044622527
0.661461355539	0.375388776849	−0.185209694281
−0.236499018781	0.344936598681	0.253811752798
0.652073156761	0.273781756507	0.706996568616

K12n629

0.0	0.0	0.0
1.0	0.0	0.0
0.0431547108308	0.290597819322	0.0
0.259720272482	−0.685216707649	−0.0297551081117
0.163065576069	0.297603194647	−0.186990311907
0.164506066392	−0.229569294761	0.662766765969
−0.0110932908769	−0.234663887639	−0.321681765367
0.294368849935	0.576374381912	0.177226849364
0.183113504281	−0.279941707856	−0.327099436356
0.225516396603	0.391240428766	0.412979298782
0.45990351515	0.736728467093	−0.495701444952

K12n646

0.0	0.0	0.0
1.0	0.0	0.0
0.364543607211	0.772136757877	0.0
0.122446733809	−0.160669272541	−0.266949458709
0.878770180626	−0.0826716181363	0.382582072243
0.141519128388	0.274363370562	−0.190991726687
0.842962665585	−0.412041726998	0.000906700008745
0.397138120331	0.479789549499	0.077571223155
0.112641522809	−0.384403290362	−0.337437718352
0.337199637672	0.482883868205	0.106844441581
0.805493804309	−0.0610595423905	−0.589450136571

K12n650

0.0	0.0	0.0
1.0	0.0	0.0
0.231417192218	0.639750316594	0.0
0.74320271975	−0.107033898432	−0.424722156235
−0.0813208780032	0.426284613985	−0.235692526121
0.758924182102	0.425093268206	0.306512988111
0.5843808691	0.00349587037011	−0.583312987023
0.769797957663	0.0157375603042	0.399270670635
0.28322417082	0.245877817956	−0.4435112773
0.367099966973	−0.309683211475	0.383723147393
0.919601700822	0.385365198444	−0.0763306994145

K12n661

0.0	0.0	0.0
1.0	0.0	0.0
0.176175819661	0.566845410927	0.0
0.450649274897	−0.39344184147	−0.0501269912769
0.649050213928	0.246083869608	0.692600369376
0.512287277345	0.633018288037	−0.219308428154
0.768304743007	−0.215668359255	0.243493940016
0.252972883158	0.324250919305	−0.422028596689
−0.00659404632055	0.0172405439798	0.493596675223
0.553442887274	0.115538829999	−0.329018714845
0.675627964503	0.39254005812	0.624050604

K12n657

0.0	0.0	0.0
1.0	0.0	0.0
0.227991925747	0.635612722723	0.0
−0.0366859098595	−0.309059986391	−0.19375013805
0.753387812675	0.0914709954286	−0.657817423648
0.472372276117	0.68083156193	0.0996021370091
0.0167806392148	−0.0867624340578	−0.351214585961
0.895988844223	−0.118020500286	0.124196673416
0.53137573653	0.71111506253	−0.299585700184
0.241377142653	−0.181346567673	0.0459762395106
0.226920636854	−0.196917152909	−0.953798018167

K12n699

0.0	0.0	0.0
1.0	0.0	0.0
0.166390343554	0.552353999424	0.0
0.838853797831	−0.137976605587	0.266901776779
0.465074470545	0.303560042612	−0.548778554473
0.186466632543	0.162288025107	0.401179281261
0.615753973044	−0.163118800278	−0.441330527155
0.480587483077	0.654143378492	0.118859218504
0.72129762413	−0.298753161144	−0.0656585658507
0.0467462252101	0.413936776106	0.126834196502
0.992619626961	0.120660682164	−0.0121357304012

K12n660

0.0	0.0	0.0
1.0	0.0	0.0
0.0179598512652	0.188672060128	0.0
0.921406136938	−0.234765350937	−0.066974381781
0.248426792702	0.0846766439049	−0.734099268263
0.327177362742	0.226596236125	0.252641415535
0.13932154281	0.210156595504	−0.729417609745
0.727514567211	0.0392935833774	0.0610473149248
0.0584392318041	0.625441516087	−0.395864926681
0.440026555073	−0.153020335959	0.102520726833
0.569708906976	0.422407533888	−0.704984848509

K12n703

0.0	0.0	0.0
1.0	0.0	0.0
0.223252210183	0.629811774275	0.0
−0.0699535708745	−0.306933103844	0.191152827008
0.58364214753	0.372995761196	−0.141276677353
−0.00995760272194	0.38986151435	0.66330699317
0.794967757028	0.213408109449	0.0967742393673
0.00986231590783	0.583977917831	−0.399499337846
0.16727124436	0.384809147185	0.567741185521
0.551935942437	−0.15134503153	−0.183638722847
0.58480697987	0.803414857155	0.111916770851

K12n709

0.0	0.0	0.0
1.0	0.0	0.0
0.100719607101	0.437372581386	0.0
0.0831224800967	−0.103764259089	0.840750415404
0.600502934303	−0.531003326851	0.0992760432357
0.591085397962	0.458341559547	−0.046009901604
0.288863210928	−0.282695700531	0.553594575398
0.58290268533	−0.22471919542	−0.400438711416
0.698575314476	0.386827948683	0.382268087715
−0.151596935886	−0.136592789206	0.439170423899
0.737339906786	−0.583747544057	0.339953918447

K12n731

0.0	0.0	0.0
1.0	0.0	0.0
0.0327346254035	0.253767009492	0.0
0.525471758416	−0.428968648524	0.539520286018
0.649071699312	0.098284723703	−0.301150241648
−0.117515264533	−0.160652719016	0.286468535811
0.492256015202	0.613517047607	0.456292441245
0.243465187991	−0.206546629534	−0.0590702366138
−0.142182590525	0.648512534489	0.287555811089
0.320828461145	−0.0959675293981	−0.193453752752
0.687644595899	0.538972146683	0.486470898237

K12n725

0.0	0.0	0.0
1.0	0.0	0.0
0.0377101581859	0.2720262126	0.0
0.619283641769	−0.462806233435	−0.348989340021
0.322965483069	0.122693933944	0.405586768019
0.0263691267754	0.31582538171	−0.52968369838
−0.306338744725	0.373883948345	0.411557330838
0.363820246894	0.136090099616	−0.291536554401
−0.38282280471	0.80000419171	−0.333276604841
0.130664283852	0.067476289185	0.113639362542
0.116680802493	0.861689356376	−0.493839086584

K12n738

0.0	0.0	0.0
1.0	0.0	0.0
0.362054286805	0.770081337922	0.0
0.374933445487	−0.22968038502	−0.0176245456687
0.604734782539	0.50563169655	0.619954851885
0.443425616787	0.306398234983	−0.346629537
0.176617756809	−0.058436188861	0.545395916131
0.021024847881	0.0940859500627	−0.430579413388
0.806910663659	−0.0715624751935	0.165192425296
0.0407888629593	0.272179165702	−0.377853678462
0.933136557533	0.353388039772	0.0661291035929

K12n729

0.0	0.0	0.0
1.0	0.0	0.0
0.0796589299146	0.391116753303	0.0
−0.446380233539	−0.244603007211	0.564927592356
0.196874515728	0.104530573166	−0.116489365606
−0.20726094012	0.344991538311	0.766037153864
0.230564167834	−0.0871911166602	−0.0223328909679
−0.228776696958	0.794841075569	0.0826679747666
0.24735831965	0.156572128232	0.687571435515
−0.106901686986	0.130864509488	−0.247222106416
0.256837393016	0.943968933864	0.20726120102

K12n758

0.0	0.0	0.0
1.0	0.0	0.0
0.062008051434	0.346657041506	0.0
0.451772806339	−0.209668810534	0.733883493605
0.529112883978	0.386396793297	−0.0653188013872
0.263119301554	−0.560784815448	0.113830338059
0.490935464764	0.175011743553	0.751563212813
0.596697392515	−0.137661877034	−0.192391034822
0.232781635153	0.634724945209	0.328170122362
0.624188655383	0.0660453416426	−0.395296568648
0.805792843025	0.0698141611298	0.588067918727

K12n764

0.0	0.0	0.0
1.0	0.0	0.0
0.0823818543175	0.397463128748	0.0
0.520159077163	-0.419301197075	0.375828603514
-0.0282453429792	0.390400194225	0.584721516018
0.344387708194	0.0515073184945	-0.279162867422
0.357839259776	0.0885039341255	0.720061985247
0.360956243303	-0.312281107846	-0.196104830647
0.0698692124777	0.542027843856	0.23450468565
0.28447454426	-0.434657055839	0.228922725641
0.971672859163	0.194643220611	-0.134036828655

K12n781

0.0	0.0	0.0
1.0	0.0	0.0
0.182014880456	0.575239379915	0.0
0.503467201126	-0.369590302987	-0.0629704362647
-0.252543028295	0.245556954409	0.160731116543
0.36333888592	-0.470937162317	0.488337051226
0.845269546866	0.235819704807	-0.0295795142675
0.0148609099211	-0.311200162805	0.0762068748649
0.921747378157	0.0871796702805	0.213503787877
0.0884038182144	-0.0705856962244	-0.316258989444
0.799221863257	-0.575455628824	0.173479775612

K12n782

0.0	0.0	0.0
1.0	0.0	0.0
0.46592732977	0.845438574299	0.0
0.341322627022	-0.13333718333	-0.162701211826
0.092233360478	0.547736232129	0.525843296574
0.687585998713	-0.0930094324643	0.0410750741711
-0.12422439146	0.217834308954	-0.453232581878
0.407176714216	0.153852604796	0.39146807896
0.581151322598	0.628906574909	-0.471119053519
0.123025847849	0.11132239449	0.251534159002
0.961479623365	-0.0404106343357	-0.271889526254

K12n801

0.0	0.0	0.0
1.0	0.0	0.0
0.0853762661129	0.404306103603	0.0
0.573052910103	-0.432546136647	-0.2486962382
-0.0799600139175	-0.215100613836	0.476763316614
0.410812530528	0.397572510735	-0.142731600271
-0.0611406687707	0.105892521212	0.689243736733
0.312657963383	0.0433417261055	-0.236154545431
0.427808851386	0.667397304213	0.536694022159
0.0613168584636	-0.121270343761	0.0430474277586
0.887342506125	0.221279688162	-0.404547372294

K12n807

0.0	0.0	0.0
1.0	0.0	0.0
0.222352804902	0.628700914551	0.0
0.415408900982	-0.350526082801	0.0619986405029
0.575375295567	0.140271086262	-0.7944643718
0.228914823985	0.505953703613	0.0693882574127
0.0919132232985	-0.109773249854	-0.706569782808
0.6382139052	-0.17995127452	0.128074219032
0.174661824204	0.689545036054	-0.0425002049062
0.277295439766	-0.242686155955	-0.38950358472
0.961934252231	0.187119844938	0.199169922467

K12n811

0.0	0.0	0.0
1.0	0.0	0.0
0.0912818302487	0.417410215452	0.0
0.198987744808	-0.532162006209	0.294469067677
0.293210451234	0.231879418842	-0.343780712895
0.176262979926	-0.0293349295232	0.614389602426
-0.00537874222087	0.0764939309492	-0.36326398503
0.344999623571	0.501554429523	0.471336861685
0.693466542642	-0.283384853293	-0.0409532207943
-0.12776992538	0.273559371926	0.0830782009772
0.832903927759	0.490313724157	0.256638849409

K12n824

0.0	0.0	0.0
1.0	0.0	0.0
0.0980502398792	0.431840977928	0.0
0.19639690446	−0.382348850133	0.572208753382
0.0771463609627	0.202774730288	−0.22991948045
0.299920294885	0.435854669878	0.716677327132
0.84348218439	−0.197817202862	0.166222578788
0.0321465860396	0.384862680727	0.119119499167
0.280040616883	−0.564630553324	−0.0732633170179
0.0836037169781	0.415535779257	−0.047062079839
0.915972550717	0.0791053512484	0.393365770926

K12n830

0.0	0.0	0.0
1.0	0.0	0.0
0.0286936794691	0.237831940026	0.0
0.804610689006	−0.232667909856	−0.420217426546
0.149942676964	0.492685508977	−0.207444750205
0.466685701051	−0.180241698455	0.461018285564
0.0484808154421	0.268963658771	−0.328487395664
0.65277925152	−0.152409102624	0.347728839063
0.22767743938	−0.0844012156369	−0.5548582075
0.80927565378	0.124673061184	0.231291564349
0.314877688213	0.947935252096	−0.0476529044232

K12n826

0.0	0.0	0.0
1.0	0.0	0.0
0.0672181923961	0.36044153396	0.0
0.412204075325	−0.564249941988	−0.161029236133
0.562156434676	0.415459540547	−0.294009008116
0.245345818829	−0.269993772165	0.361570727522
0.843516488224	−0.0950153428173	−0.420461496583
0.209786547199	0.61363909142	−0.110307898049
0.34807784468	−0.290539972278	0.293840265143
0.205562966883	0.508470981085	−0.290343786345
0.914832576099	−0.193547210015	−0.354430296679

K12n831

0.0	0.0	0.0
1.0	0.0	0.0
0.01413851088	0.167562299668	0.0
0.47608155333	−0.501195274746	−0.582556376839
−0.188630310505	0.196300455522	−0.314866548241
0.414899445723	−0.3422527763	0.273106452705
0.4555682403	0.463180963081	−0.318182428143
0.113878686954	−0.46750696761	−0.187537011844
0.436963484583	0.171893796719	0.510161258268
0.333728600843	0.178075899929	−0.484476535293
0.382331131901	−0.819122859284	−0.427622084296

K12n829

0.0	0.0	0.0
1.0	0.0	0.0
0.0413598580818	0.284620937921	0.0
0.809231967547	−0.301571841264	−0.258361082859
0.477360754657	0.458328658965	0.300577847442
0.0313397057996	0.382590587166	−0.591234334835
0.0463506483372	−0.135273852356	0.264096650155
−0.277348938132	−0.566350696118	−0.578157072005
0.399368689158	0.151737047375	−0.74064782731
0.609376183954	−0.0609172087465	0.213645114864
0.455627437299	0.888022036476	−0.061810202345

K12n841

0.0	0.0	0.0
1.0	0.0	0.0
0.171040309998	0.559308351763	0.0
0.52380423018	−0.178346658464	0.57569323646
−0.0109017254004	−0.0357709288781	−0.257230350912
0.763529197162	0.232990132906	0.315503651787
0.224592330485	−0.0322007190148	−0.484009241038
0.81187531001	0.592981620917	0.0300391455915
0.361194353101	−0.265284985721	0.275528670843
−0.255764071411	0.252806073286	−0.316876559553
0.591634160436	0.0439004183442	−0.80501041824

K12n850

0.0	0.0	0.0
1.0	0.0	0.0
0.122932372232	0.480366918429	0.0
0.590488898816	−0.402586714133	−0.0422347865444
−0.0906268877606	0.182649934014	0.397741747991
0.517747806136	−0.225926428386	−0.282659301327
0.190328528246	0.4363966442	0.391228496445
0.467347258352	−0.290942111393	−0.236656013464
0.124931023381	0.587352059308	0.0970361676564
0.208290280294	−0.402515513337	0.211985821467
0.200256134611	0.286143153407	0.937026988036

K12n883

0.0	0.0	0.0
1.0	0.0	0.0
0.39502848167	0.796247111147	0.0
0.397986335331	−0.0883544098661	0.466338289361
−0.0694030643937	0.248892465738	−0.350859173876
0.86292793086	0.301043464354	0.00696646611141
−0.0518265470785	0.703218765045	−0.0314948469879
0.56711910152	−0.0818339097854	−0.055960778884
−0.267228172314	0.353293195022	0.282460599443
0.491672162579	0.091476761526	−0.313796423032
0.374536879193	0.881245344412	0.288320601202

K12n851

0.0	0.0	0.0
1.0	0.0	0.0
0.18372473655	0.577663132179	0.0
0.348887757372	−0.370702572858	0.270783430185
0.376053770327	0.523964046879	−0.175124236568
0.870652629117	−0.295386911279	0.114765356638
−0.101782038216	−0.337175492588	−0.114635018778
0.542274108201	0.397141002307	0.0997733896111
0.034561951334	0.151068491341	−0.72586374928
0.266164606585	0.531747910278	0.169369957681
0.652440155431	0.259657762285	−0.711968882794

K12n885

0.0	0.0	0.0
1.0	0.0	0.0
0.0349988420851	0.262245620026	0.0
0.691668704483	−0.294195182721	0.509075951952
0.393700212686	0.650609051943	0.372841829729
0.932379296374	−0.0697179979768	−0.0641407625463
0.264947261378	0.0557724225884	0.669880104329
0.739733751058	0.55317919713	−0.0561806988118
0.502554296962	0.081617262936	0.793157425126
0.138936661339	0.0346881584825	−0.137208026844
0.633563616577	0.467569800073	0.6164216299

K12n859

0.0	0.0	0.0
1.0	0.0	0.0
0.0941098405163	0.423512714036	0.0
0.174586175974	−0.573002797818	−0.021917893705
0.414668156861	0.371024282708	−0.248133529076
0.623713033185	−0.585481974659	−0.0446734118553
0.352690828766	0.124193122271	−0.694987352586
0.16666708776	−0.0382130041314	0.274042790335
0.614556538003	−0.374066713357	−0.554568895777
0.267622403197	0.260821801904	0.135759489338
0.858588100033	−0.456905975716	−0.232515384084

K12n887

0.0	0.0	0.0
1.0	0.0	0.0
0.0206184019607	0.202019022426	0.0
0.783443787339	−0.36885860555	0.303638214488
−0.0659241015659	0.140134876539	0.163996442489
0.750786134013	−0.267953331433	−0.243984446298
0.477949074984	0.496393595406	0.340253274713
0.263936549476	−0.361653674981	−0.126601649977
0.476727061068	0.612857158935	−0.0555465111295
0.629997211374	−0.314293614248	0.286359477134
0.740158012999	−0.046571286983	−0.670818329372

K13n62

0.0	0.0	0.0
1.0	0.0	0.0
0.294836484563	0.709044721084	0.0
0.518901566235	0.110615756309	0.769205832852
0.713935424121	0.0169322804545	-0.207106207753
0.0123891377122	0.0287463800911	0.505419746214
0.666963816529	0.585133415254	-0.00640586564556
0.398152825898	-0.377952433635	0.00795724632961
0.843606847641	0.515583983677	-0.0482867351246
-0.0576980298439	0.3932236623	0.36725805136
0.901290299729	0.424681841861	0.0855635951103

K13n592

0.0	0.0	0.0
1.0	0.0	0.0
0.314584521912	0.728152197275	0.0
0.272893191275	-0.0079725297408	0.675560670277
0.876410553311	0.218102873093	-0.0890678054905
-0.0234489649476	0.583332477235	0.149385929345
0.482012584471	-0.0430655265756	0.742794863287
0.793629991097	0.281954312984	-0.150097457086
0.273012125318	0.597921099833	0.643074672681
0.30813162756	-0.083027808499	-0.0884136763742
0.513544177304	0.654034571675	0.555437806609

K13n468

0.0	0.0	0.0
1.0	0.0	0.0
0.148241602472	0.523934759527	0.0
0.105587091346	-0.475133011357	0.00664694377837
0.382674689993	0.28061717978	0.599996850049
0.19666961833	-0.691458563888	0.456920430305
0.291423397475	0.140660817502	-0.089521750033
-0.16648823259	-0.660548658849	0.295679903723
0.299587325572	-0.375596341331	-0.541921284687
0.0601078940789	0.0372667022	0.33682424684
0.558339159867	-0.812809032138	0.16612904573

K13n604

0.0	0.0	0.0
1.0	0.0	0.0
0.121912444652	0.478499994924	0.0
0.35944713398	-0.466952539569	0.222927738037
0.31137970407	0.530502668714	0.275583503628
-0.185804450093	0.136203142505	-0.497291518921
0.318845346163	-0.175404464847	0.307835354422
0.275701347202	0.594685507796	-0.328639334303
0.39577251753	0.0697667905166	0.514001309332
0.0527866156843	0.232979458785	-0.411051281634
0.743498267114	0.642693789397	0.184810767728

K13n588

0.0	0.0	0.0
1.0	0.0	0.0
0.279984530437	0.693958012843	0.0
0.301676052716	-0.21300407013	-0.420653370259
0.381032102041	0.662663920573	0.0556954383823
0.354904843622	0.0235062214589	-0.712936334335
0.215565505942	0.0297046509472	0.277288957428
0.170185215915	0.460681428871	-0.623932239708
0.875496247509	0.167756765527	0.0216151948901
-0.117945807568	0.0938091401351	-0.0655893457217
0.627332119067	0.711714821761	-0.316095594517

K13n628

0.0	0.0	0.0
1.0	0.0	0.0
0.396404558633	0.79729075196	0.0
0.395846587814	-0.0503801652896	-0.530522105777
0.839946720141	0.496251834625	0.17938530307
0.538905707783	0.0334313926213	-0.654384177867
0.759593743683	-0.0206264572776	0.319461056077
0.380744499	0.692180510688	-0.270775740661
0.733448237596	-0.23903236133	-0.36265968794
-0.0200917089728	0.175540145417	0.147543394737
0.906438938349	0.390297178862	-0.161358492858

K13n725

0.0	0.0	0.0
1.0	0.0	0.0
0.48910305916	0.859641969567	0.0
0.0119088765045	−0.0167229819898	−0.0653466427875
0.649885386676	0.22973941976	0.664202709206
0.403203226224	−0.0455645963143	−0.26496660284
−0.243469715709	0.141169935879	0.474590237881
0.113353424799	0.300468127817	−0.445899486365
0.693733223435	−0.23831902184	0.164729448995
−0.144979380855	0.215152864997	−0.136807307062
0.787210729685	0.508876860715	−0.348344093817

K13n1466

0.0	0.0	0.0
1.0	0.0	0.0
0.298950957935	0.713113062999	0.0
0.978974876631	−0.0159188552322	0.0779739200072
0.119174228781	0.286914495655	0.489112348699
0.362768621628	0.695184716694	−0.390647390312
0.658042493478	0.0957517327139	0.353324005858
0.0149781329629	0.277649884329	−0.390572015555
0.212257995071	0.76354461562	0.460889648943
0.374443064823	−0.0813926543781	−0.0487935986901
0.398698354361	0.917081766372	0.000809949954955

K13n1192

0.0	0.0	0.0
1.0	0.0	0.0
0.239728465659	0.649605414133	0.0
0.796621248826	−0.178875511497	0.059074393129
−0.174434755215	−0.0695989019416	−0.153314070822
0.508012457178	0.661335652432	−0.154006544817
0.47713117709	−0.233496685345	0.291326402324
0.834910525856	0.293653844066	−0.479456483409
0.317257211449	0.281976914094	0.376054296997
0.767472826858	0.0491298077437	−0.485971297
0.759820836643	0.512314705968	0.400257340036

K13n1642

0.0	0.0	0.0
1.0	0.0	0.0
0.156753370265	0.537526856483	0.0
0.00300074005105	−0.449284282098	0.050635022222
0.66830074142	0.294301337638	−0.0161207588062
−0.25311897163	0.231623036499	0.367359544428
0.308339896678	−0.262672294601	−0.296294028493
0.43786513368	0.486500496069	0.353293027026
0.354578511483	0.175881119239	−0.593585498076
0.00446060463351	−0.174159447012	0.275258016765
−0.965245173785	0.0690133012491	0.252069273685

K13n1394

0.0	0.0	0.0
1.0	0.0	0.0
0.189045321806	0.585108972684	0.0
0.178629104591	−0.41408826787	0.0386830310109
0.755463240359	0.189490764471	0.589096268071
0.390142163532	−0.0700230562686	−0.304879731423
0.519013271945	−0.0578445049007	0.686706835803
−0.0174904544231	0.262628312302	−0.0939729481207
0.724822841691	−0.316162355227	0.243624939305
0.179114961163	0.280153878857	−0.345110874196
0.986788796081	−0.0235405686665	0.160292587341

K13n1692

0.0	0.0	0.0
1.0	0.0	0.0
0.011656649926	0.152241329357	0.0
0.909079974737	−0.228772660928	0.222395403037
0.71599719928	0.481464229765	−0.454570327942
0.89072371643	−0.0818916871093	0.352957228942
0.371928827569	0.0751346711295	−0.487396616834
0.494534255733	0.443293900874	0.43424685574
0.87253677917	−0.283399196689	−0.139365586792
0.202770964558	0.402443297316	0.145298824388
0.967362708882	−0.130436546511	−0.217245706056

K13n1697

0.0	0.0	0.0
1.0	0.0	0.0
0.327439837416	0.740042449935	0.0
0.87204805766	−0.090075417176	−0.119608583078
0.177029807309	0.291711824043	0.4896435274
0.305819708056	−0.44032293358	−0.179339488153
0.813971320206	0.374947201254	0.0983591728398
−0.0504609756363	0.0625127047517	0.492239219682
0.227971524197	0.220302813871	−0.455166514151
0.681834833348	−0.137172764628	0.361056070309
0.722767819615	0.634723147673	−0.273373745517

K13n1700

0.0	0.0	0.0
1.0	0.0	0.0
0.0983418722341	0.432449558485	0.0
0.245519100535	−0.294455889775	0.670781136258
0.725125635134	0.323040826846	0.0473427857117
−0.229497860861	0.0971531860026	0.241427186447
0.628273868774	0.350578092778	0.688644668736
0.671726359212	0.244778585702	−0.304792971671
0.0165566354269	0.140338207356	0.443434828138
0.681664493584	−0.192142204138	−0.225211799754
0.706196389169	0.55930409743	0.434126233396

K13n1708

0.0	0.0	0.0
1.0	0.0	0.0
0.236969436795	0.646362405787	0.0
0.394006305967	−0.116379913048	0.627346456736
0.0605155430604	0.236883667379	−0.246718045346
0.434237359	0.409749961243	0.66457183649
0.310859318419	0.513616383277	−0.322337290774
0.747398866331	0.365582174586	0.565085436096
−0.046004165434	0.445040859595	−0.0384027133828
0.670942428982	−0.188924664133	0.251554689487
0.563807323427	0.803482901318	0.191145309488

K13n1718

0.0	0.0	0.0
1.0	0.0	0.0
0.348010445923	0.758227948163	0.0
0.0298479807182	−0.189426081789	−0.0269162636777
0.501176800848	0.637795437549	0.278949231695
−0.0459392471163	0.218376874584	−0.445448517543
0.403137001718	0.440910784135	0.419889093932
0.423533652225	−0.27182181678	−0.281250133498
−0.10150823341	0.57715962265	−0.221571545777
0.410099484423	−0.137500834612	0.255416896305
0.682449273047	0.694486730311	−0.227927995517

K13n1719

0.0	0.0	0.0
1.0	0.0	0.0
0.122961228675	0.480419601591	0.0
0.0948494872272	−0.518745435977	−0.0296472206908
0.424956399178	0.425087583935	−0.0152022490212
−0.358299244332	−0.187072619558	0.0932896039862
0.284254696545	−0.41243742056	−0.639059451815
0.151898522948	0.106880425168	0.205209947381
−0.036170835165	0.520935223081	−0.685401382473
0.145792988315	−0.0185497233253	0.136696640603
0.514303674938	0.806462400601	−0.291736398761

K13n1720

0.0	0.0	0.0
1.0	0.0	0.0
0.396091109904	0.797053356095	0.0
0.189148157321	−0.181120249692	−0.0187352960047
0.332743355905	0.772594833743	0.245476661656
0.501470604558	−0.0616646169636	−0.279444555736
0.135755230046	0.397407024955	0.530188381114
0.581243043517	−0.309676558693	−0.0189686217405
0.270694823318	0.592531181311	−0.318269468395
0.321831724953	−0.275234153689	0.17606679435
0.852439859444	0.397164747261	−0.340009484521

K13n1735

0.0	0.0	0.0
1.0	0.0	0.0
0.31755790476	0.730939660057	0.0
0.461709760211	−0.198992758365	0.33829859553
0.0839492141131	0.21118189663	−0.491794003047
0.550434641148	0.107501831134	0.38663743445
−0.0106628329074	−0.331573873955	−0.315062038122
0.840741253899	0.0999145833039	−0.0168527287069
0.0604091088208	0.0299977729513	0.604591864952
0.639645070769	−0.0339303000935	−0.208057445552
0.501562914852	0.803394898253	0.320922545025

K13n1762

0.0	0.0	0.0
1.0	0.0	0.0
0.083972947724	0.401116491183	0.0
0.568917877239	−0.473125536777	−0.0230063444915
0.678128978801	0.51615827954	0.073898072689
−0.0250966401239	−0.179043054965	−0.0749939465398
0.465168661999	0.648119018901	−0.349662541564
0.552185352619	−0.159394591323	0.233732577423
0.146533908499	0.0186292286694	−0.662790944521
0.294295365331	0.378616066492	0.258390920514
0.8986802	−0.00739330557796	−0.438542172613

K13n1756

0.0	0.0	0.0
1.0	0.0	0.0
0.00857559606129	0.130681487881	0.0
−0.0691288376952	−0.483435358637	0.785380493645
0.424968956118	−0.534296499192	−0.0825368494993
0.120557898037	0.403653897619	0.0835443379968
−0.251716440331	−0.439256513725	0.472020663453
0.405053646065	0.0923447269964	−0.0628187278386
−0.11086537696	−0.55836446162	0.494321392357
0.356212111726	0.00966481276122	−0.183307830013
0.572081455974	0.433111704954	0.696517809365

K13n1786

0.0	0.0	0.0
1.0	0.0	0.0
0.403469465966	0.802590382427	0.0
0.69758052957	−0.0490203436475	−0.433886913262
0.427241477373	0.489655750464	0.3640760323
0.106958684783	0.147140634459	−0.519157984299
0.816325158759	0.402138475877	0.137938132316
0.239624522336	0.734832004029	−0.608206218514
0.457053317398	0.0210906830626	0.0576000940296
0.0195514823997	0.90675552757	0.213131208526
0.810667909956	0.523019096197	−0.263189218589

K13n1757

0.0	0.0	0.0
1.0	0.0	0.0
0.253659838148	0.665564694682	0.0
0.156065363899	−0.321544150737	0.126852063017
0.607245987557	0.559650454933	0.2680331941
0.408013268524	−0.319632388859	−0.164595982308
−0.126127574408	−0.0243481948011	0.627553501471
0.664911962727	−0.120272440971	0.0233556947163
−0.0101839903258	−0.478361511178	0.668350014048
0.188295806214	0.18678335805	−0.0515027995915
0.770074567838	−0.458635637639	0.443439411708

K13n1860

0.0	0.0	0.0
1.0	0.0	0.0
0.139645062109	0.509695380445	0.0
0.678332110385	−0.306866581963	−0.207467649451
0.424026646747	0.416744905507	0.434182680843
0.596102865977	−0.261801097387	−0.279935724418
0.194338558105	0.553385259626	0.13726523946
0.316517296252	−0.434581367193	0.232103524117
0.214178883681	0.364287268816	−0.360632295378
0.755602632216	−0.379505560244	0.0313275902748
0.69639072993	0.48680096428	0.527318473451

K13n1861

0.0	0.0	0.0
1.0	0.0	0.0
0.173195052071	0.562488735958	0.0
0.292833932018	−0.298279455615	0.494736959181
0.0873119859146	0.243988877528	−0.319944441453
0.802691064456	−0.452088545676	−0.259042923482
0.157641060227	−0.113475782401	0.425976702946
0.56986859288	0.0442989636853	−0.471339066903
0.271652206348	0.185433466752	0.472667309583
0.108111511042	−0.735098183156	0.117877340029
0.858646675189	−0.181820026046	0.479236231222

K13n1916

0.0	0.0	0.0
1.0	0.0	0.0
0.113620119255	0.462958645033	0.0
0.084495126217	−0.475452178339	0.344291825867
0.323243594896	0.367837310759	−0.137228689042
−0.0959046164815	−0.481566222475	0.183440010128
0.21526719003	0.457702961208	0.0387143820714
0.532901801587	−0.279942885646	−0.55709335383
−0.199660138743	−0.425890097676	0.107776870258
0.422977812492	0.340504479549	−0.0502146917998
0.61790990026	−0.219568807574	0.754968140985

K13n1868

0.0	0.0	0.0
1.0	0.0	0.0
0.0157938685735	0.177026243429	0.0
0.718058920528	−0.482570520717	−0.267872927956
0.575904046046	0.48447561494	−0.0566532243956
−0.0145079843557	−0.320314946724	0.00438599425412
0.709866200107	0.275654829151	−0.342171457155
0.181581289379	−0.0348378277923	0.44808759093
0.43632420102	−0.0748167561877	−0.518094448984
0.390674821761	0.0733352025907	0.469816038501
0.930132250962	−0.0865915588683	−0.356869580733

K13n1926

0.0	0.0	0.0
1.0	0.0	0.0
0.118391132856	0.471980725638	0.0
0.335577803831	−0.246986023244	0.660239929082
0.256059587146	0.455007759489	−0.0474899503358
0.29903261479	−0.544055825975	−0.0424629138707
0.274993569098	0.175442217525	0.651615388399
0.120674466277	−0.0313915912036	−0.314513686865
0.92753804612	0.295127928288	0.17778314119
0.00912101686388	−0.0850933431126	0.287062348482
0.710622620181	0.626835000558	0.319520537309

K13n1911

0.0	0.0	0.0
1.0	0.0	0.0
0.115475547365	0.46649382921	0.0
0.727957330148	−0.293156237561	0.21862717538
0.349501031231	0.171672163192	−0.581813570499
0.461052049046	0.14714817609	0.411642490171
0.397416239409	−0.012591966369	−0.573463377551
0.943695834352	−0.227485629147	0.236103987063
0.134582041092	0.341124526594	0.0877215071504
0.951766370554	−0.219415840786	−0.0464584772717
0.675943928106	0.72346025482	0.140374733309

K13n1945

0.0	0.0	0.0
1.0	0.0	0.0
0.152810606239	0.531291004158	0.0
0.564225719423	−0.353303210188	0.219614846015
0.752322556813	0.515838326315	−0.237782759236
0.463757175205	0.00503261934684	0.572036696115
0.655132670887	−0.154478594682	−0.396431988072
0.184408488772	0.487514982986	0.208764666416
0.287797504323	−0.352937575033	−0.32316597679
0.772147522219	0.171742484824	0.376916800425
0.810697662375	−0.21144402736	−0.54594937816

K13n1965

0.0	0.0	0.0
1.0	0.0	0.0
0.0571730342065	0.33328263167	0.0
0.127412090332	−0.643759096489	0.201136611367
0.140697680302	0.338502272179	0.38818231894
0.565971229298	−0.00433376843871	−0.449436841405
0.119715062713	0.558117029889	0.246626757159
0.0359257361872	−0.143175438994	−0.461305599672
0.305863576518	−0.572775206411	0.400423825492
−0.066197060086	0.195003877761	−0.121194963086
0.789943926323	0.564039118578	0.240517080431

K13n2102

0.0	0.0	0.0
1.0	0.0	0.0
0.383810594479	0.787598004393	0.0
0.805143868569	−0.0571447112386	−0.329981842731
0.538034330889	0.509041805394	0.449816415323
−0.190817802235	0.0553218755559	−0.0629338097478
0.718338475853	0.470864127931	−0.0904928101952
0.289453669608	0.340940818493	0.803474614624
0.188517342059	0.357154201318	−0.191286152595
0.748072410993	−0.0654476385793	0.521669533086
0.692341529052	0.714340164314	−0.101888845301

K13n2000

0.0	0.0	0.0
1.0	0.0	0.0
0.0769185210836	0.384604450418	0.0
0.294550366749	−0.489517437606	0.434220341105
0.297538292487	−0.60907932583	−0.558601912466
0.177166798976	−0.285479646919	0.379904321589
0.999128902118	0.0242583604391	−0.0980503496884
0.0911337012033	0.0852663205448	0.31646472111
0.256562529242	−0.621938691745	−0.370917540406
0.707167704286	0.135795642522	0.101092687128
0.512537688968	−0.843161266851	0.162432125734

K13n2104

0.0	0.0	0.0
1.0	0.0	0.0
0.138486035544	0.507733876206	0.0
0.0474151356608	−0.486716985504	−0.0526647400005
0.590533250234	0.276130493871	0.298172026649
0.353504293347	−0.0531247051477	−0.615834695162
0.590505777901	−0.115157915339	0.353692084846
−0.0942109319302	0.336536644199	−0.218265126982
0.704624519416	−0.247066326831	−0.072424481488
−0.131090448606	0.282213554757	0.0740108256315
0.757850870735	0.600301149236	−0.255539797197

K13n2046

0.0	0.0	0.0
1.0	0.0	0.0
0.10564227772	0.447352505971	0.0
0.60763049575	−0.172806646676	−0.602835345967
0.260430228548	−0.198150194554	0.334613148103
0.631358037852	0.322965658258	−0.434055069162
0.372248820562	−0.070879005123	0.44784560248
0.13169032108	0.576206668367	−0.275626400774
0.265860083491	0.248053032532	0.659421013074
0.448481466816	−0.137887091544	−0.244846453432
0.636633316038	0.752060680198	0.170595293636

K13n2118

0.0	0.0	0.0
1.0	0.0	0.0
0.256371253389	0.668592766349	0.0
0.75043841694	0.0953810118914	0.653701707549
0.593180039795	0.482831092555	−0.254677198971
0.754708671594	−0.378813763166	0.226442997776
0.711855006712	0.620165795884	0.240704975374
−0.030655382911	0.00390815802642	−0.0217923485825
0.845667115909	−0.151351814695	0.434226531435
0.469303248299	−0.0113865138681	−0.481611856996
0.858838286492	0.365745021082	0.358646590964

K13n2149

0.0	0.0	0.0
1.0	0.0	0.0
0.0767754898269	0.384260983988	0.0
0.336174624201	-0.358907106476	0.616776522253
0.460316395955	0.0348493230409	-0.294016920148
0.208254923266	0.0932232118686	0.671932096669
0.146795669579	-0.172110746622	-0.290263647766
0.360530863426	0.234304569943	0.598074045554
0.79552872554	0.166677659238	-0.299814288764
0.00884184237078	-0.0787992840267	0.266635018919
0.975778448963	0.151728369134	0.157590991299

K13n2261

0.0	0.0	0.0
1.0	0.0	0.0
0.334745026387	0.746616246865	0.0
0.611524670136	-0.159562738992	-0.319738446853
0.0117913412025	0.0650751655806	0.448283522882
0.948252462098	0.0842451530676	0.0980363521143
0.211101211729	-0.0699088900245	-0.559872885606
0.252402124938	0.00359488908821	0.436566489883
0.0580817824188	-0.525786387826	-0.389263437001
0.406186022775	0.410731725112	-0.347343728221
0.953985792919	-0.206432612194	0.217478007008

K13n2180

0.0	0.0	0.0
1.0	0.0	0.0
0.367076097762	0.774214010449	0.0
0.629163571072	-0.189811157632	-0.0443354445184
-0.325509364508	0.0622100315985	-0.202717597079
0.578335881671	-0.0976909079977	0.194139380276
0.392483450666	-0.135005729155	-0.787729489793
0.585137680532	0.24693309802	0.116154949729
0.266218362562	-0.700728381297	0.131260883796
0.399051158609	0.277302549424	0.291918740267
0.872464682272	-0.213184771884	-0.439724494683

K13n2264

0.0	0.0	0.0
1.0	0.0	0.0
0.135358065865	0.502388620229	0.0
0.514229028645	-0.276915652964	0.499140905302
-0.0458554995739	0.534402080988	0.331603280201
0.524248084609	-0.156145945738	-0.113509431464
0.327320193582	-0.0609632422744	0.862277255623
0.350182736583	0.407683372612	-0.0208125781329
0.00655759210983	-0.475083276356	0.299569699085
0.0393388740292	0.429447969212	-0.125575703508
0.703574180283	0.351096890445	0.617830354029

K13n2255

0.0	0.0	0.0
1.0	0.0	0.0
0.282678446601	0.696742268726	0.0
0.580077754993	-0.236518637677	0.201439151973
0.363493263433	0.406381656877	-0.533251510331
0.126981914847	-0.145096251973	0.266707549896
0.360922390336	0.817690681241	0.131381369278
0.217799363216	-0.0139261661504	-0.405208994262
0.715573976922	0.165572611693	0.443319510093
0.0197923625254	0.0486486576892	-0.265353005282
0.609265610934	0.791217821939	0.0526286383963

K13n2267

0.0	0.0	0.0
1.0	0.0	0.0
0.177226958157	0.568370056931	0.0
0.553975118741	-0.353276465713	-0.0928897776594
0.638054491161	0.616104793303	0.137827871865
0.354102847177	-0.311625798484	-0.104426979361
0.356260744652	0.659512679803	-0.342933581929
0.689731338728	0.0010654131053	0.331784551712
0.33165956921	-0.180531425954	-0.58407962813
0.196959960276	0.185964666307	0.336537898159
0.580581386337	0.684569719345	-0.440782886685

K13n2280

0.0	0.0	0.0
1.0	0.0	0.0
0.0236516923185	0.216203566315	0.0
0.299239345657	−0.739766668297	−0.100858097654
0.303450889158	0.243219296435	0.0827742961134
0.487735457756	−0.553436221992	0.658429733625
0.111849073602	−0.163880070154	−0.182376683319
0.484483848847	−0.363259870567	0.723929567054
0.431580540516	0.270119023154	−0.0481017904411
0.0242055169139	−0.591078235595	0.255847007331
0.426484654202	−0.619289650748	−0.659235290475

K13n2490

0.0	0.0	0.0
1.0	0.0	0.0
0.0686380257657	0.36409459341	0.0
0.392078544409	−0.425162858121	0.521975963147
0.0170405729035	0.501045475762	0.483444908457
0.282486235694	−0.0617888619505	−0.299342488221
−0.105903551106	0.21257090096	0.580362061048
0.564670661272	−0.10436186661	−0.0903717509321
−0.182323205035	0.558870537246	−0.0442963543118
0.350833727277	−0.156572456268	0.407239921704
0.915193364447	0.268864871881	−0.300221228996

K13n2308

0.0	0.0	0.0
1.0	0.0	0.0
0.211352812636	0.614846008251	0.0
0.347673216874	−0.341923028156	0.256923643055
0.64546330913	0.516053809744	−0.16164153297
0.749372365501	−0.110300578588	0.610940558604
0.539374750702	−0.113024325435	−0.366757545609
0.54951322236	0.325835666737	0.531740711854
0.601589267213	−0.0263354911874	−0.402745008251
0.0200097642965	0.487830893342	0.227650273146
0.916414816727	0.0765296359142	0.392844878431

K13n2492

0.0	0.0	0.0
1.0	0.0	0.0
0.37230452585	0.77845898526	0.0
0.31071852295	−0.218844270104	−0.0399171778364
−0.15928284552	0.609792269806	0.26415550815
0.710223613181	0.30747599828	−0.126438130108
−0.250401846397	0.0313413456086	−0.0956423511153
0.634987859854	0.134598406217	0.357593842826
−0.109474682255	0.084770185264	−0.308208433975
0.169985291568	0.544825663612	0.534555518667
0.546279637742	0.752219986956	−0.368434049203

K13n2442

0.0	0.0	0.0
1.0	0.0	0.0
0.402179387132	0.801629911387	0.0
0.23006211609	−0.170742593468	−0.15769387056
0.226459115163	0.274535067528	0.737691422486
0.480102994284	0.406831534874	−0.220516502399
−0.192969276615	0.644724036867	0.479755498785
0.566916923854	0.00547091819556	0.597774194788
0.351113373018	0.614037790616	−0.165819407359
0.193279508298	0.0480734749835	0.643360958554
0.541324694915	0.831046544017	0.127785822186

K13n2498

0.0	0.0	0.0
1.0	0.0	0.0
0.13610837547	0.503677735329	0.0
−0.0225855811016	−0.140075896174	−0.748597014471
0.255414997688	−0.320370723257	0.194912102348
0.817847233817	0.436337188591	−0.138349230406
0.192461880806	−0.125476498571	0.403184278397
0.76792744757	−0.0622453038529	−0.412193669234
0.551648832991	0.227462446552	0.520165156664
0.602065663281	0.182540553598	−0.477552321762
0.830902607646	0.258009686256	0.492982614708

K13n2522

0.0	0.0	0.0
1.0	0.0	0.0
0.086466213404	0.406762855664	0.0
0.43144855902	−0.51347025044	−0.184819402779
0.230962330295	0.26708360494	0.407245586004
0.126851919962	−0.264583280194	−0.433284809468
0.717524967273	0.216395766999	0.214607548367
0.213904636454	−0.53539037645	−0.211049774961
0.108331161809	0.437989522665	−0.414484809924
0.409718413321	−0.384386286305	0.0680747754632
0.475640153031	−0.0649538584479	−0.877238531471

K13n2588

0.0	0.0	0.0
1.0	0.0	0.0
0.173726843327	0.563269625101	0.0
0.649037067156	−0.309306573626	−0.112654198936
0.0875733067845	0.398099149326	0.316689007513
0.4958955192	0.255791416473	−0.584988030022
0.356432194921	−0.259589903213	0.26054853128
0.224366089934	0.546096973134	−0.316883024141
0.559738769041	0.223485120259	0.568242254276
0.0532985297829	0.0490081785213	−0.276196068434
0.894826286177	0.434559135118	0.102197238967

K13n2527

0.0	0.0	0.0
1.0	0.0	0.0
0.125954542833	0.485844150738	0.0
0.390349746182	−0.420227539622	−0.330347193684
0.794880709579	0.336291609655	0.183494685137
0.284949785238	0.586142085895	−0.639636648201
0.683561265441	−0.0192514608554	0.049281011177
−0.120573550539	−0.00260965943006	−0.544932963898
0.0424914347532	0.49717409612	0.305729136033
0.702013721369	−0.0156187891918	−0.243883282159
0.191022146279	0.751811268158	−0.631102493025

K13n2633

0.0	0.0	0.0
1.0	0.0	0.0
0.0986662373294	0.433125210846	0.0
0.214197445839	−0.270587241339	−0.701028761536
0.692881215574	0.00500089945639	0.132585672867
−0.0389549107047	0.340750936068	−0.460447038869
0.283074611322	−0.304784136026	0.232071161354
−0.0237620335659	0.518884862828	−0.244815254557
0.84281192158	0.128229289654	0.0657291116952
−0.0616354338096	0.134790214117	−0.360805688291
0.603001942435	0.797581394795	−0.0158926428504

K13n2568

0.0	0.0	0.0
1.0	0.0	0.0
0.0632141170535	0.349903143044	0.0
0.690077665258	−0.334903531767	0.371593743309
0.779694993225	0.62854439862	0.119132221563
0.125867373293	−0.0843312104159	−0.134477339489
0.557251119308	−0.104531660086	0.767465012055
0.432295291322	0.0769215082205	−0.207963503401
−0.029411172585	0.220080832568	0.667440716967
0.393658609529	0.126800802834	−0.233842144023
0.740025981777	−0.362056470363	0.566812719126

K13n2769

0.0	0.0	0.0
1.0	0.0	0.0
0.00608124388051	0.110115876393	0.0
0.562211622446	−0.286640957201	−0.730275986893
0.599974610999	0.30929558532	0.0718671387299
0.0308929920886	−0.483817598304	−0.145198724501
0.168233801123	0.506110023031	−0.179561592401
0.188630952174	−0.485072857731	−0.0486400391204
0.0327738119068	0.0544497848552	−0.876060047318
0.200972610352	0.0405554235177	0.109595121047
0.550598481856	−0.65137779882	−0.522061562444

K13n3021

0.0	0.0	0.0
1.0	0.0	0.0
0.371024768871	0.777425339583	0.0
0.514830742989	−0.135122357812	−0.382853159561
−0.35426520129	0.278039532168	−0.110879829421
0.595535914748	0.206678431155	0.193727185003
0.0952737226826	0.276908055623	−0.669293984515
0.609587976048	0.713807394142	0.0686760804518
0.320532636717	−0.228831127636	−0.0982958575098
−0.0199531439319	0.562103092693	0.410125711947
0.666780475552	0.678932923618	−0.307333503951

K13n3180

0.0	0.0	0.0
1.0	0.0	0.0
0.0867160006102	0.407323380692	0.0
0.332245838117	−0.461070166096	0.43082217537
0.353504883306	0.30626115974	−0.210076170226
0.487294103231	−0.387014826969	0.4980684837
0.877902175373	0.241531623102	−0.174504704943
0.37116057243	−0.187888869026	0.573031908734
0.842942323574	−0.0281531336188	−0.294093499798
−0.00764289066589	0.176380233046	0.190334921373
0.80570937857	−0.315193611002	0.50148318503

K13n3054

0.0	0.0	0.0
1.0	0.0	0.0
0.43941825834	0.828099094866	0.0
0.668536564861	−0.0910557796908	−0.320404616377
0.230185895066	0.140092580545	0.548168423644
0.0913709221285	−0.0541426044547	−0.42291504146
0.790917137714	−0.132529178244	0.287360001963
0.505775419544	0.537893766945	−0.397641658708
0.735499102158	−0.369629419717	−0.0460329339649
0.155442715402	0.381895331421	0.268204454978
0.908738604984	0.202990532673	−0.364676557317

K13n3232

0.0	0.0	0.0
1.0	0.0	0.0
0.0878126049044	0.409773298579	0.0
0.0387870688068	−0.588050679203	0.0440886172662
0.656089384441	0.191483345852	−0.0620459901613
−0.255344882778	−0.190728678791	0.0902745427845
0.500029443871	0.448896058034	−0.052167805835
0.0682188581861	−0.413484818238	0.212102590409
0.515002525306	0.383456500632	0.618635355477
0.488705256629	−0.0122331560147	−0.299372351072
0.728856222827	−0.215710878332	0.64979798662

K13n3158

0.0	0.0	0.0
1.0	0.0	0.0
0.187368953877	0.582778502415	0.0
0.400926843226	−0.380224671815	−0.164371269753
0.615151618305	0.196930800435	0.623663822482
0.147864254644	0.0183692497258	−0.242222020092
0.323292890358	0.894511420802	0.206776520924
0.288280260851	−0.101758055026	0.127901637028
0.47268019857	0.225933796023	−0.798713015201
0.205090597655	0.0719570311685	0.152437320638
0.713958894879	−0.0691313414267	−0.696766498947

K13n3352

0.0	0.0	0.0
1.0	0.0	0.0
0.0959838893744	0.427498387984	0.0
0.88856669397	0.0126603868233	0.44690259638
0.617874890039	0.123015111947	−0.509417319718
0.224401174259	0.438999451657	0.353908998685
0.0587872894439	−0.0763770111911	−0.486899625615
0.431926908838	0.424642239801	0.293963060505
0.0569607377713	0.732168993367	−0.580581201609
0.203636238375	−0.0952813030472	−0.038536642107
0.538618731465	0.836136529801	0.103757243836

K13n3354

0.0	0.0	0.0
1.0	0.0	0.0
0.0614844365633	0.34523692906	0.0
0.231554879262	−0.637704376408	0.0700173872931
0.353597993929	0.315655669478	−0.206044383095
−0.0431337363164	−0.156096270079	0.581390720098
0.168365592529	0.141153625352	−0.349689584475
0.587722619722	−0.00711300567069	0.545942421356
0.00316316609592	0.412881686196	−0.148243939775
0.4390136352	−0.321024988003	0.372731455179
0.768485588199	0.607422095382	0.201167340223

K13n3602

0.0	0.0	0.0
1.0	0.0	0.0
0.348687718099	0.758809799255	0.0
0.605375586975	−0.165661670846	0.281893311277
0.0889992444881	0.689842917947	0.320199596339
0.878565446551	0.28428169913	−0.140349326525
0.126260115911	−0.350543632593	0.0358139150833
0.763050068528	0.356620681265	0.343087717175
0.644881334203	−0.331523344347	−0.372799110642
0.32062693035	0.25604775798	0.368564013132
0.938174153562	−0.271320874943	−0.214974976236

K13n3393

0.0	0.0	0.0
1.0	0.0	0.0
0.11871973706	0.472594009857	0.0
0.423487694018	−0.463522064114	0.175508371494
0.126864889048	0.483501654182	0.298638337611
0.798916063697	0.112638594983	−0.342304569343
0.396480697362	−0.372091747034	0.434279148906
0.704525216051	0.365034591889	−0.167180188847
−0.151192919735	0.0392227985945	0.234806312715
0.652272017909	−0.0275858736817	−0.356785349908
0.716389272565	0.490617740755	0.496065159642

K13n3950

0.0	0.0	0.0
1.0	0.0	0.0
0.119620153545	0.474269254703	0.0
0.876915405024	−0.178018263938	−0.0320139830692
−0.0865843829989	0.0808864360425	0.0360779753899
0.881358659178	−0.117061041277	−0.118528180125
0.127467514903	−0.314321304919	0.508158768016
0.660825555027	0.261452784852	−0.111529378218
−0.214571389221	0.105190670171	0.345922631851
0.446660073079	−0.0861435706698	−0.379449108395
0.760316215252	0.57505306216	0.302048387721

K13n3582

0.0	0.0	0.0
1.0	0.0	0.0
0.123981786355	0.482278020816	0.0
0.0539160391411	−0.514644245888	0.0351679572522
0.657253134323	0.27656696337	0.13501369788
−0.0579702893718	−0.302820890001	0.525865549051
0.553228346045	−0.0220049301427	−0.214120008074
0.390524089573	0.736602206903	0.416786115331
0.280758857061	−0.252983985542	0.509903038898
0.408969057363	0.107266723026	−0.414099975986
0.883872935418	0.0555493230552	0.464416738225

K13n3956

0.0	0.0	0.0
1.0	0.0	0.0
0.177284939096	0.568453981041	0.0
0.457108993416	−0.391303919433	−0.023733333119
0.323421203168	0.595912827602	0.063046094815
0.248994218745	−0.401099840284	0.0836946798643
−0.00235571896914	0.540950143852	−0.138487759138
0.78275546708	0.0783542451693	0.273344075551
0.423624122344	0.130792173811	−0.658468642149
−0.00650884038284	0.201841125187	0.241496735454
0.790041380847	0.562539481278	−0.243688219972

K13n3960

0.0	0.0	0.0
1.0	0.0	0.0
0.129524442574	0.492211645458	0.0
0.866645987171	−0.16924147096	−0.138317038983
0.120053801381	−0.21639052103	0.52529208934
0.635839351222	0.249009058495	−0.193991233108
0.315865888251	−0.689606117995	−0.0650783421415
0.824007067053	0.17066261157	−0.106674680179
−0.150806171987	−0.0522447022074	−0.0994998312148
0.708439888354	0.175380761978	0.358629905697
0.767618805621	0.0837857620338	−0.635406417451

K13n4031

0.0	0.0	0.0
1.0	0.0	0.0
0.0800874587204	0.392123598367	0.0
−0.0598574760816	−0.577654651541	0.199863856731
0.465969029407	0.237585562022	−0.0428085156437
−0.37153851334	−0.19068551536	0.296551175715
0.482567312052	0.0326091106904	−0.173175073293
0.233690349827	−0.0453207649102	0.79221976415
−0.643128864513	0.198526031661	0.377820433592
0.206333847975	−0.0531299974398	−0.0859492755418
0.493852515713	0.0146897862314	0.869421591004

K13n3975

0.0	0.0	0.0
1.0	0.0	0.0
0.201793101583	0.602383388981	0.0
0.274727882794	−0.394312090096	−0.0357580715176
0.520068795055	0.519750962338	0.287191727903
0.115243578633	0.610968401687	−0.622641181431
0.453209835302	0.28772215624	0.261265303531
0.757033334645	−0.149173555094	−0.585383040626
0.347149210727	0.428311317232	0.120666693595
0.783415912144	−0.463265218572	0.242168323367
0.878793804285	0.457057870281	−0.137184375073

K13n4066

0.0	0.0	0.0
1.0	0.0	0.0
0.285784150639	0.699925510695	0.0
0.106739201387	−0.281811478402	−0.0643070010692
0.794830373096	0.400614381858	0.182321230617
0.384949156265	−0.501897723361	0.0501497964
0.694766443354	0.443441441093	−0.0515709624026
0.656185211992	−0.273507632925	0.644486157274
0.33061960198	−0.245901036501	−0.30063018975
0.687343930963	0.376132022048	0.39637958578
0.902219650369	−0.266091622042	−0.339403817255

K13n3998

0.0	0.0	0.0
1.0	0.0	0.0
0.107852756349	0.451744723983	0.0
0.451961901442	−0.17038246571	−0.703240112699
0.734700700652	0.136323435167	0.205599951223
0.0992408757242	−0.615623583679	0.38100374751
0.135727802043	0.0352847954526	−0.37727521579
0.816142002566	0.0827919357519	0.354011039616
0.273208798153	0.471978630306	−0.390137636609
0.394735114921	−0.37313123398	0.130458820947
0.868773825513	0.494912055462	−0.0171492700104

K13n4147

0.0	0.0	0.0
1.0	0.0	0.0
0.404326209052	0.803226452987	0.0
0.359997759042	−0.174075043981	−0.207163637119
0.529102106973	−0.0743405027636	0.773375368122
0.420981293308	0.272956557673	−0.15812591554
−0.109442257109	−0.555514391807	0.0215592063577
0.556839551556	−0.313824489619	−0.683887136479
0.299846583378	0.189789099962	0.140932823692
0.0194096897149	−0.657266698672	−0.310566481593
0.891053252692	−0.178860373681	−0.417172707152

K13n4304

0.0	0.0	0.0
1.0	0.0	0.0
0.0555535246032	0.328665263012	0.0
0.748007233666	−0.382682563337	0.120383266085
0.503480084279	0.125412005763	−0.70547772831
0.383299383241	0.273291633161	0.276198498813
0.707818377525	−0.190738572702	−0.548036534655
0.273193257577	0.128332078279	0.294159953578
0.434745896243	−0.242959427264	−0.620194115069
0.648743993673	−0.0145338127284	0.329556669569
0.741230559944	0.176114624683	−0.64773520514

K13n4629

0.0	0.0	0.0
1.0	0.0	0.0
0.0966937895552	0.428996375476	0.0
0.852774222653	−0.208420630635	0.14846527879
0.264095813686	0.447933346189	−0.323400367261
0.454083086894	−0.14017094089	0.462753678418
0.248382389555	0.0290476205271	−0.501119913702
0.646698180682	0.293622137741	0.377142493202
−0.0424731766004	0.133028848583	−0.32943562405
0.341804389508	−0.211797409983	0.526967087055
0.97924175625	0.0833872583589	−0.1847488781

K13n4548

0.0	0.0	0.0
1.0	0.0	0.0
0.328034308849	0.740582277614	0.0
0.117976550765	−0.216877661891	−0.197853992912
0.90270175464	0.331401088158	0.0912770615413
0.0155205862354	0.108432767675	0.495250702376
0.176041662044	−0.265883199624	−0.418051296333
0.796188997764	−0.108438078488	0.35047216839
0.283500880159	0.479444152975	−0.275263699207
−0.104498829637	−0.358306206209	0.108963526382
0.577844758776	−0.560030173024	−0.593684798573

K13n4806

0.0	0.0	0.0
1.0	0.0	0.0
0.182011324491	0.575234323332	0.0
0.50861516943	−0.353450628106	−0.175710527409
−0.00902157988849	−0.0031873492446	0.604909630694
0.0743637062656	0.334509732986	−0.332644407592
0.831776001596	0.0651766858448	0.262154991029
0.236860044599	−0.452177042091	−0.35300362616
0.47274281827	0.46826636367	−0.0413255007213
0.214609594821	−0.478836125686	0.149368268467
0.948262718596	0.192863254652	0.252193539818

K13n4607

0.0	0.0	0.0
1.0	0.0	0.0
0.186611290082	0.581720557122	0.0
0.532242936788	−0.356456271766	0.0190526253695
0.170961008086	0.549856977836	−0.20019988109
0.333853051994	−0.373952904314	−0.546669913954
0.0585201576446	0.351759058069	0.0838330162088
1.00560210264	0.0334207630366	0.0426441902507
0.210744279877	−0.224145536734	−0.506774268502
0.194724614142	0.249217612935	0.373947423547
0.693049736191	0.580692695397	−0.427174503778

K14n6809

0.0	0.0	0.0
1.0	0.0	0.0
0.113319643398	0.462382898922	0.0
0.526292160977	−0.111253433458	−0.707386074147
0.76961935146	−0.126579767163	0.262437096264
0.146104153521	0.244149414648	−0.425885990441
0.732235077807	0.470523817679	0.352063345472
0.36555210878	−0.075830805564	−0.400957388563
0.519453061787	0.754255189211	0.135019978443
0.343540807951	−0.224947572583	0.0339416412656
0.709514587045	0.676369504081	−0.197770940027

K14n7228

0.0	0.0	0.0
1.0	0.0	0.0
0.493083863581	0.861995377388	0.0
0.616035021345	−0.0845209217337	0.2983117636
−0.194677520027	0.11454276266	−0.252250517
0.611307012374	0.163719415641	0.337639803596
0.579909462024	0.114681567765	−0.660663498666
0.125154179492	0.298987727334	0.210673905876
0.736801813703	−0.341571416687	−0.253622502224
−0.0126573753065	0.18068262708	0.153270159025
0.973731393966	0.227659012882	−0.00430653668194

K14n10375

0.0	0.0	0.0
1.0	0.0	0.0
0.112604931999	0.461009754004	0.0
0.506049128517	−0.0337067502868	−0.774891763157
0.625596286901	0.389113435563	0.123401934561
0.295223802639	−0.363696180703	−0.44592372207
0.589726203572	0.563595792558	−0.214843796134
0.856326831161	−0.30003537144	0.213017534136
0.5406281454	0.103257655443	−0.645870743975
0.254748431306	0.021388728688	0.308891146708
0.881818363897	−0.10502252258	−0.459746280948

K14n7243

0.0	0.0	0.0
1.0	0.0	0.0
0.022994647732	0.213214778192	0.0
0.509492342097	−0.619101360614	0.265649841823
0.477160699109	0.304641171069	−0.115997115486
0.194676458942	−0.390691844387	0.544846778089
0.649252046642	0.0774159932755	−0.212936889844
−0.128392246317	−0.189893597287	0.356110503982
0.517041751056	0.566638631503	0.461343302276
0.368438065585	−0.159141932356	−0.210340788491
0.731978304597	0.181637723883	0.656670007585

K14n13229

0.0	0.0	0.0
1.0	0.0	0.0
0.173629853319	0.563127321903	0.0
0.490342672728	−0.384730911882	0.0354648934459
0.166123881059	0.308820891605	0.678790682614
0.590385654339	0.320571210297	−0.226672667139
0.429060740384	−0.235725659721	0.588500973595
0.379230875438	0.443718988961	−0.143531781095
0.551550531268	0.0213656158225	0.746369092269
0.253321366095	−0.186993328398	−0.18510603644
0.754124064235	0.656679292626	0.00831879668938

K14n7739

0.0	0.0	0.0
1.0	0.0	0.0
0.310609830202	0.724390222039	0.0
0.723096726582	0.0218014468221	0.579847888031
0.498149933271	0.796341535663	−0.0113260212022
0.804256244215	−0.14209243974	−0.171452846594
0.501862730114	0.574507909638	0.457070901486
0.274216519219	0.322046254587	−0.483375968567
0.6806235843	0.586918455263	0.391081586012
−0.156447019399	0.2252677834	−0.0194322334443
0.708515495357	0.677030855643	0.199085442326

K14n13823

0.0	0.0	0.0
1.0	0.0	0.0
0.0536758617515	0.323219159965	0.0
0.777653850638	−0.363670810921	0.0635455702971
0.492028277338	0.579756025971	0.231961232599
0.616033401845	−0.351206907519	0.575371694823
0.767821011768	0.00540224186196	−0.346469091893
0.401903428779	0.330471468344	0.525559761101
0.883362869112	−0.126827515926	−0.22215304894
0.0977687873708	−0.109916281459	0.396358025239
0.897059566671	0.424738569642	0.12198885729

K14n19201

0.0	0.0	0.0
1.0	0.0	0.0
0.163546560317	0.548037994342	0.0
0.75125963963	-0.260870697096	0.0161265408691
-0.234789521248	-0.152437336951	-0.110163833818
0.726186450711	0.104571169177	-0.212495691492
-0.126144480508	-0.399413877731	-0.0727421363272
0.295773577825	0.502812925447	0.0165436278229
-0.28115114785	-0.278074604241	-0.222982001042
0.628471085996	0.0350297827413	0.0500620147227
0.405618870921	-0.446014342732	-0.79783741303

K15n14178

0.0	0.0	0.0
1.0	0.0	0.0
0.208737044951	0.611476030574	0.0
0.151716009909	-0.386277857232	-0.0351536759217
-0.13870599767	0.554414961899	0.140209026925
0.632755269296	-0.0394826834322	-0.0881177136048
-0.28959314446	-0.422366411477	-0.0364122550857
0.442040646149	0.238198251006	0.132010792976
-0.188082604931	-0.410773277093	-0.294346620662
0.545449342413	-0.0675809288862	0.292296281245
0.701854011441	0.465456037553	-0.539213894228

K14n22175

0.0	0.0	0.0
1.0	0.0	0.0
0.181238031879	0.574133120067	0.0
-0.109172942634	-0.381996084491	-0.038450098475
0.601939298013	0.3189849785	0.0158171156497
-0.152307973653	-0.157685412852	-0.435731764531
0.204840511989	0.209552463661	0.423093771453
-0.0638235126032	-0.266630850611	-0.41420491665
0.155846964345	0.585957789627	0.0599654030601
-0.0499745653312	-0.370374720526	-0.147557193168
0.214633704629	0.138282412537	-0.9668559082

K14n23230

0.0	0.0	0.0
1.0	0.0	0.0
0.117430152672	0.470181310334	0.0
0.548190624963	-0.429606180707	-0.0694829941555
0.415097941506	0.555563085353	0.0388122265174
0.586430651813	-0.326410982174	0.477864440485
0.236408734957	0.35802377878	-0.161692996903
0.74732784391	-0.299695912729	0.39181081655
0.536867535485	-0.140446293492	-0.572733644504
0.377971689461	-0.0139358107876	0.406422731098
0.688609894993	0.685062933159	-0.237708203747

Appendix D

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