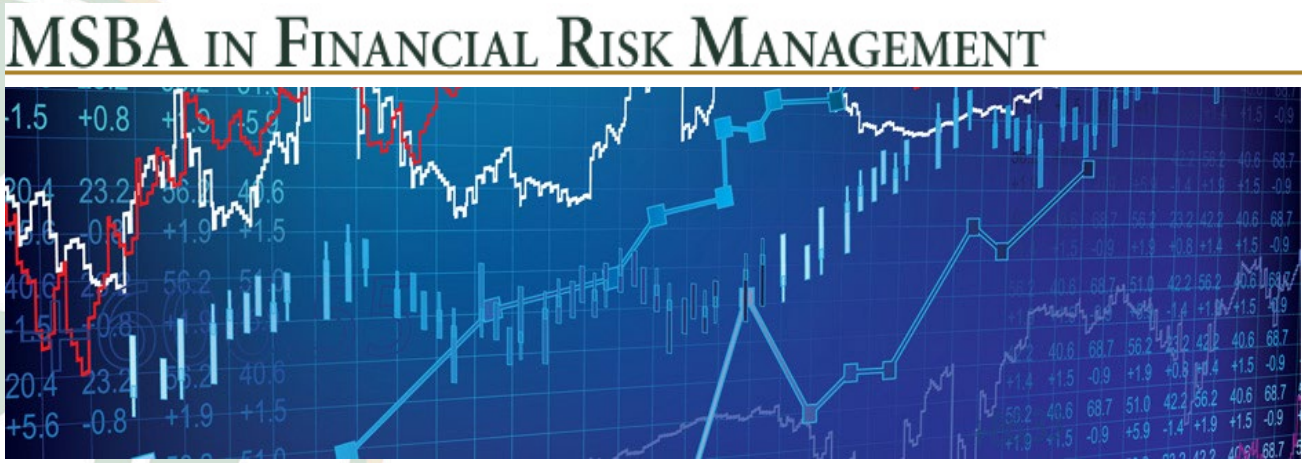
Financial Risk Management

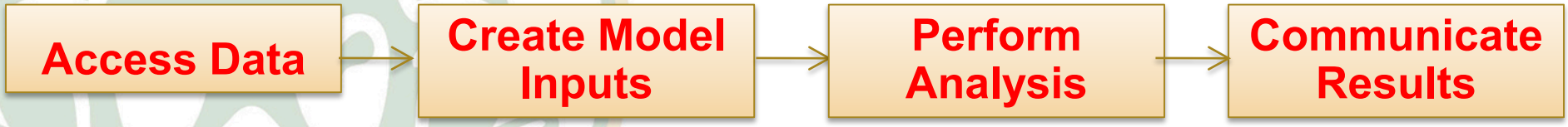


Monte Carlo Simulation with Crystal Ball

ORACLE®
CRYSTAL BALL

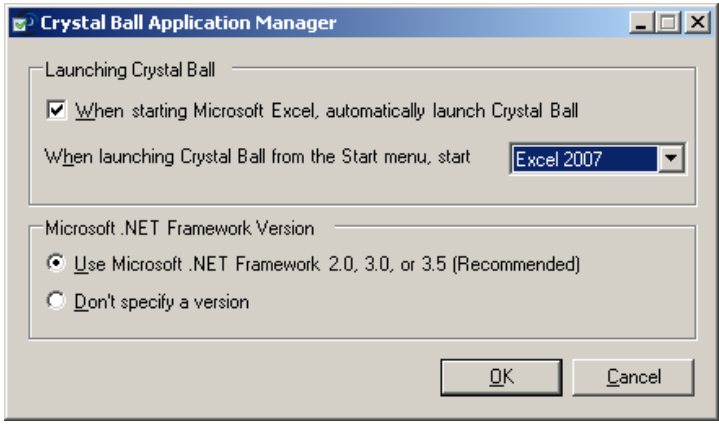
Crystal Ball Modeling

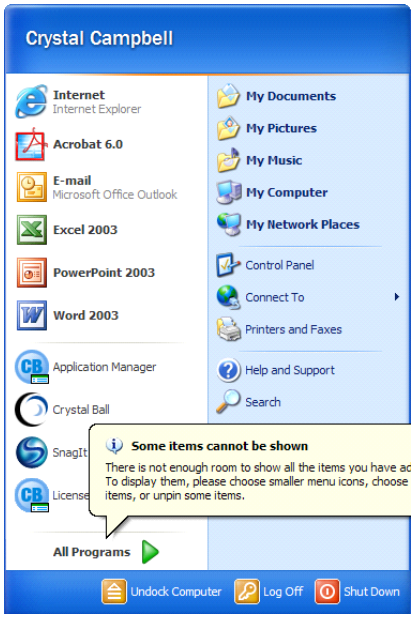
- Reduce complexity and increase standardization
- Increase forecast accuracy & consistency of data
- Gain insight to key drivers through sensitivity analysis
- Move from data manipulation to improving business processes



Launching Crystal Ball

- Launch automatically with MS Excel after Crystal Ball installation
  - Start>Programs>Oracle Crystal Ball >Application Manager
  - Check the Crystal Ball box
- Start Manually
  - Start menu
  - Crystal Ball





Launching Crystal Ball

Excel Ribbon

Simulation controls and other run preferences

OptQuest (optimization), Predictor (time series) and other analysis tools

Define and manage model inputs and outputs

Charts, reports, and data extraction

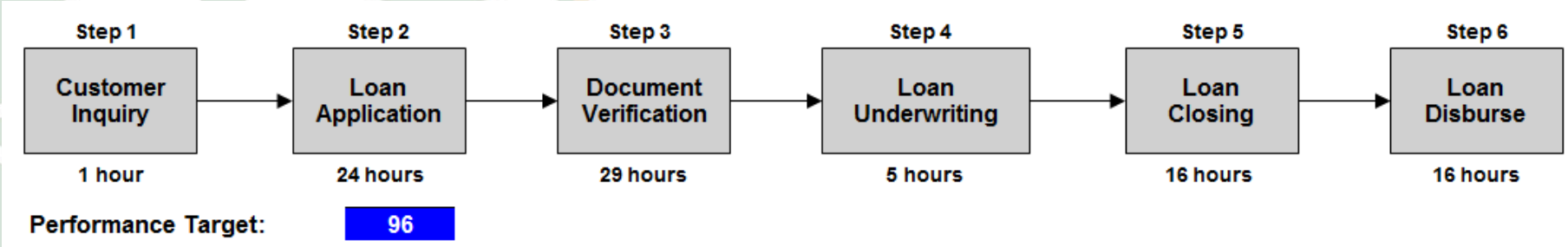
Help, examples guide, and documentation

Basic Terminology

Crystal Ball Term	Common Names
Assumption 	Input, X, independent variable, random variable, probability distribution
Decision Variable 	Controlled variable
Forecast 	Output, Y, f(X), dependent variable

Loan Process

- 6 steps in a loan process
- The **average** cycle time is 91 hours
- Performance target is 96 hours

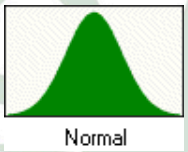


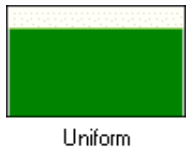
Loan Process

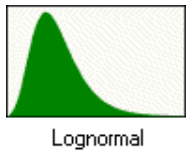
- Performance target is 96 hours – what should we do?
- Choice 1: Nothing – the average (91 hours) gives us all the information we need.
- Choice 2: Investigate the uncertainty around the inputs (process steps) – and analyze the effect on the output (cycle time)

Loan Process

- In this example, we have the **average** completion time for each process step. Instead of using the average, let's define a **distribution** of completion times.
- The distribution you choose can be based on the underlying nature of the process, historical information, expert opinion, or an educated estimate. In this example we are given the distribution and related parameters.







Loan Process

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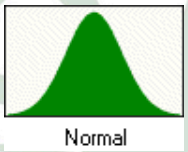
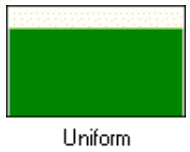
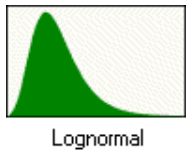




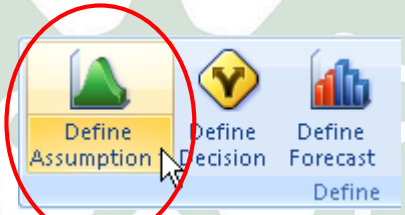


Example: Create Crystal Ball assumption for Customer Inquiry

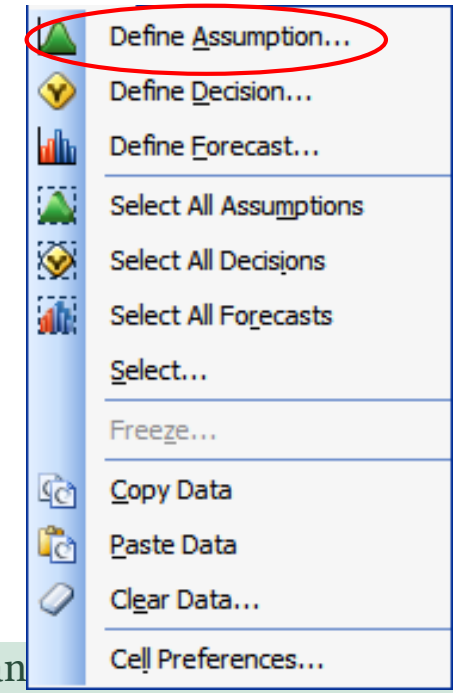
1. Select the cell that will be your assumption

Process Step	Simulated Cycle	Assumption Parameters		
Step 1:	1	1	0.25	*lognormal (mean, st dev)*

2. Click on the 'Define Assumption' button on the toolbar or ribbon, or select it from the 'Define' menu



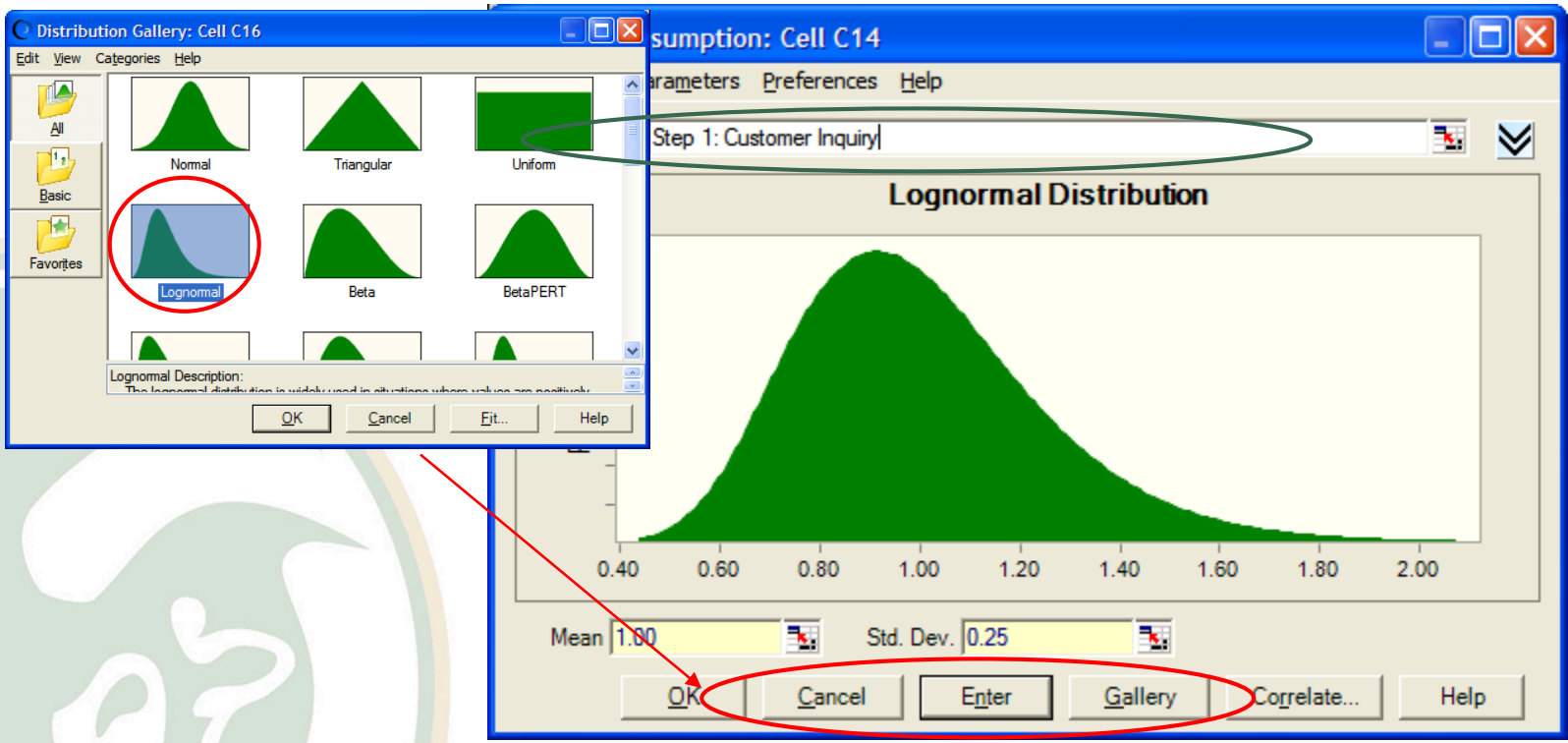
Excel 2007



Example: Create Crystal Ball assumption for Customer Inquiry

- Crystal Ball assumption for cell C14: lognormal (1,.25)

3. Select the lognormal distribution from the gallery



4. Enter a descriptive name and values for the distribution parameters
suggestion: use cell referencing for the name and parameters

Example: Create Crystal Ball assumption for Customer Inquiry

- Crystal Ball assumption for cell C14: lognormal (1,.25)

- When an assumption has been defined, Crystal Ball assigns the cell a green background

Process Step	Simulated Cycle	Assumption Parameters		
Step 1:	1	1	0.25	*lognormal (mean, st dev)*

- Or, use Crystal Ball Function: cb.lognormal (1, .25)

Create Crystal Ball assumptions for remaining loan process steps

- Create assumptions for the remaining steps using the distributions and parameters listed in the 'Assumptions Parameters' section of the spreadsheet

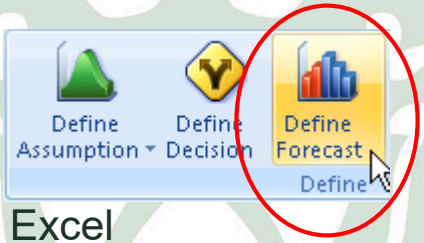
Assumption Parameters			
1	0.25		*lognormal (mean, st dev)*
8	24	40	*triangular (min, likely max)*
16	32	80%	*custom (two conditions)*
32	48	20%	
1	8		*uniform (min, max)*
			(fit to data on Data tab)
16	4		*normal (mean, st dev)*

Create a Crystal Ball forecast for Cycle Time

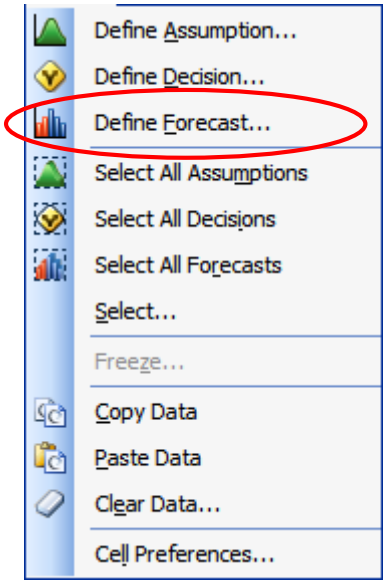
1. Select the cell that will be your forecast

26	Cycle Time	91

2. Click on the 'Define Forecast' button on the toolbar or ribbon, or select it from the 'Define' menu

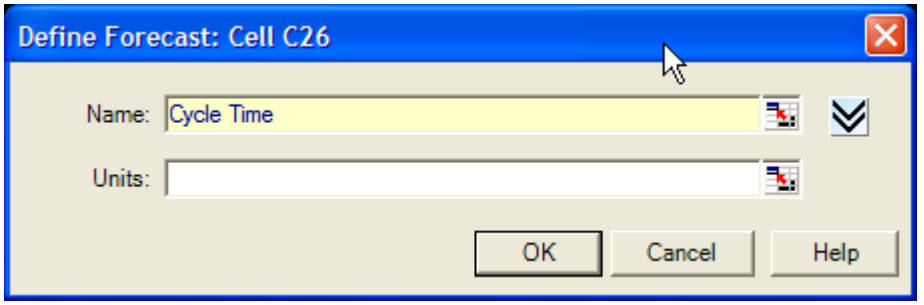


Excel



Create a Crystal Ball forecast for Cycle Time

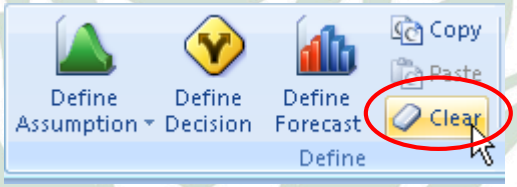
- Crystal Ball forecast for cell C26

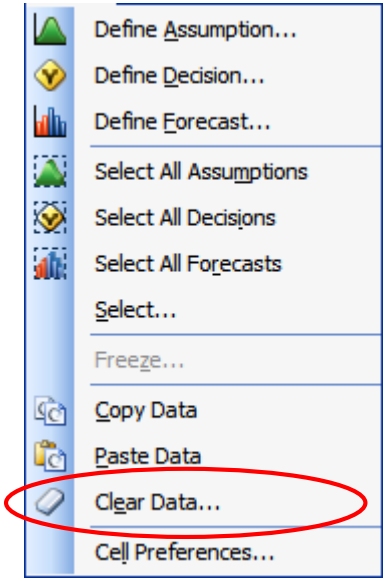


3. Enter a descriptive name for the forecast.
   suggestion: use cell referencing for the name

4. If you want to clear Crystal Ball information from a cell, use 'Clear Data'

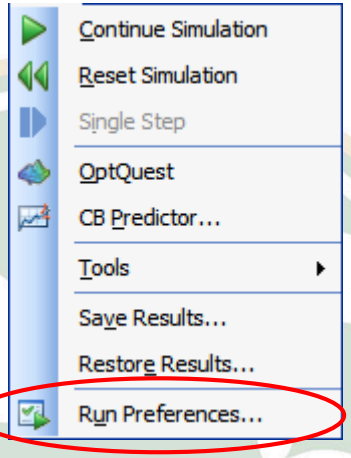
Excel 2007

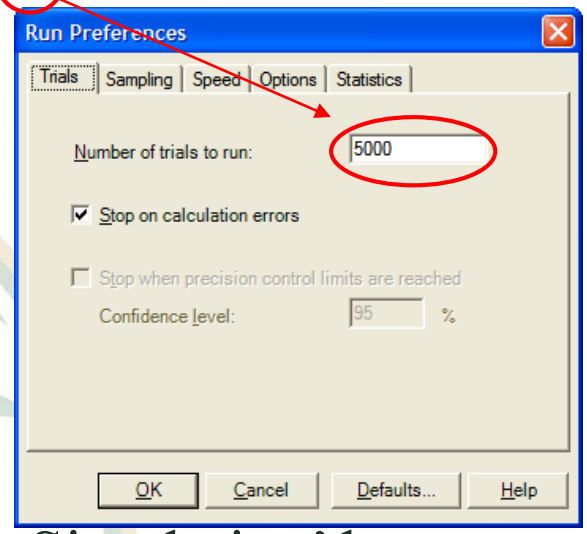


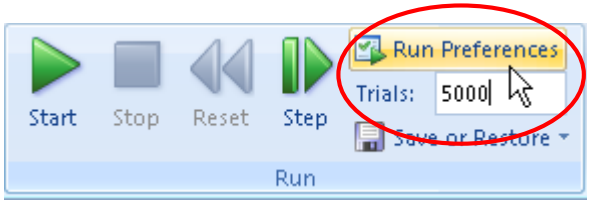


Run the model!

- Set the number of trials to 5000 in the 'Trials' tab of the Run Preferences dialog – on the toolbar or in the 'Run' menu.



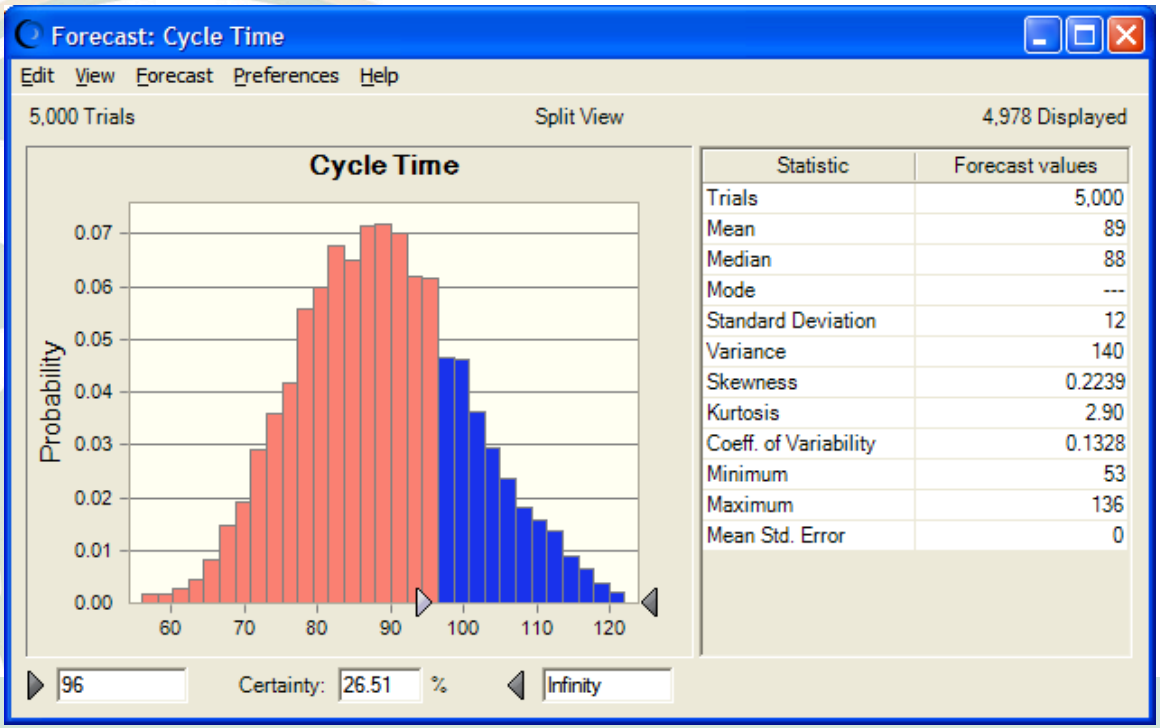




- Click on the 'Start Simulation' button.

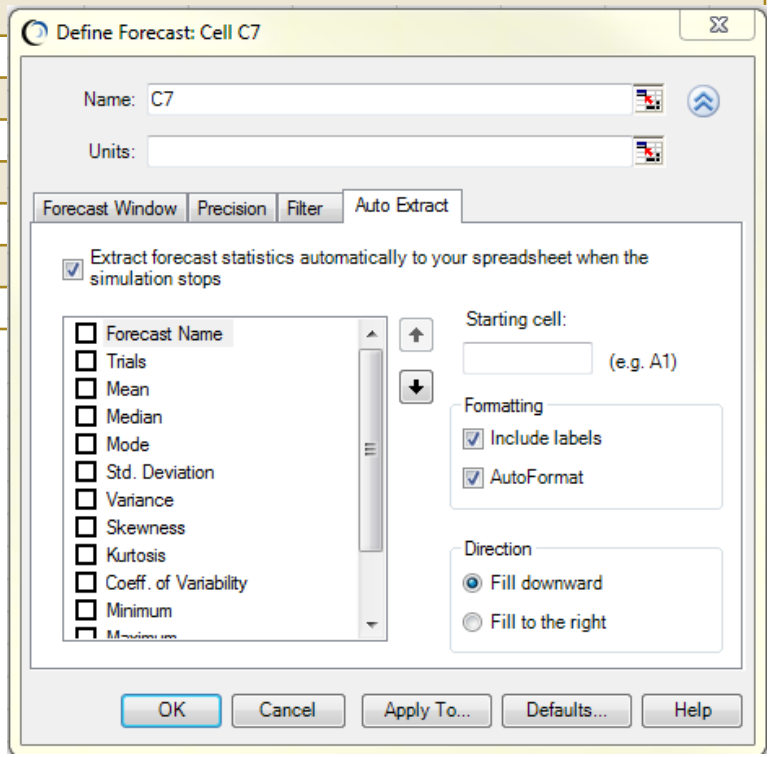
View the forecast results

- View the forecast output
- Are your results different? Why?
- How often did you exceed your target?
- What was the mean cycle time and standard deviation?



View the forecast Statistics

1	Runs
2	Mean
3	Median
4	Mode
5	Std. Dev.
6	Variance
7	Skewness
8	Kurtosis
9	CV
10	Minimum
11	Maximum
12	Range
13	MSE

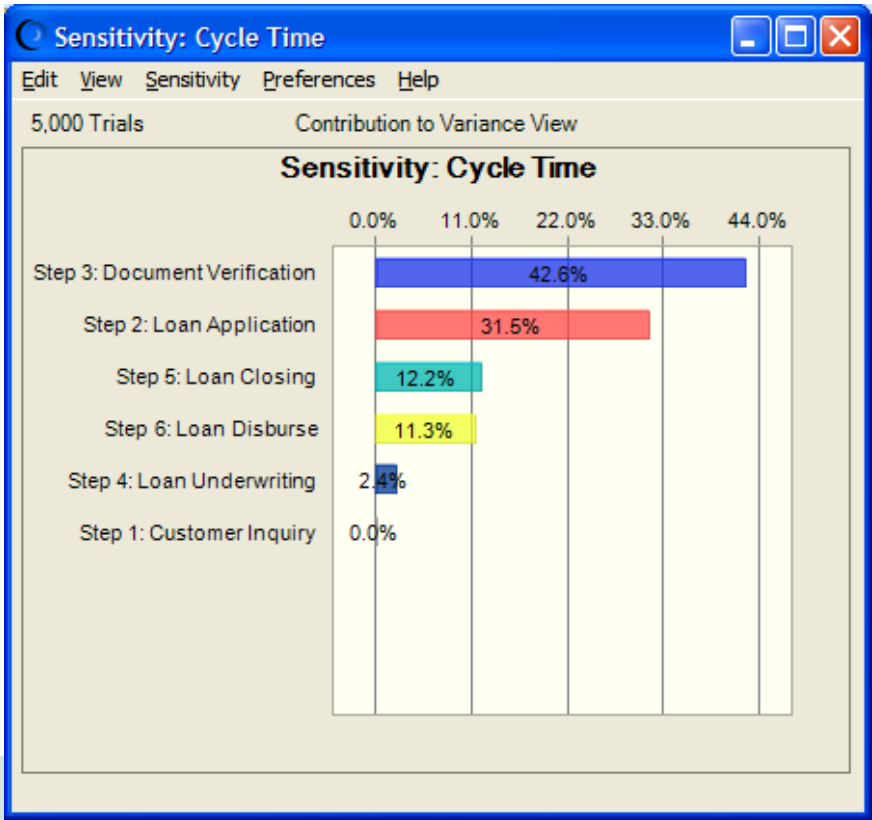


- Method 1: Auto Extract

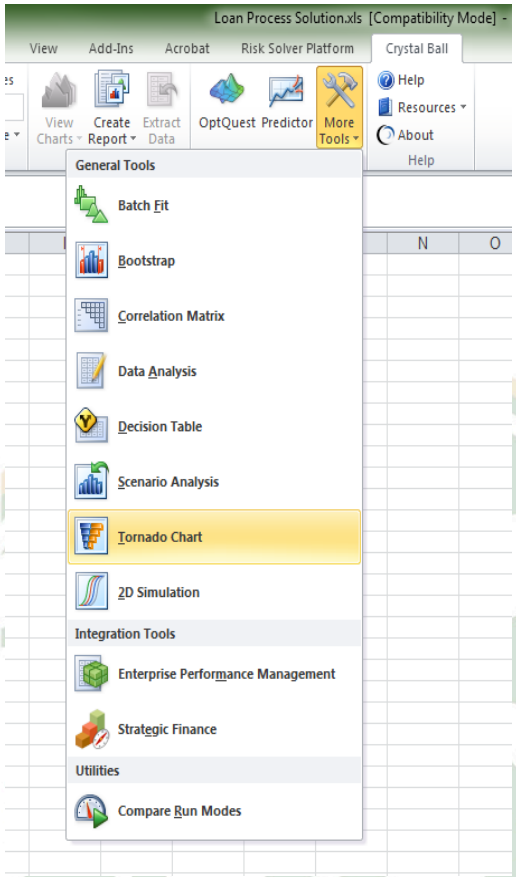
- Method 2: CB.GetForeStatFN(Cell, Argument)

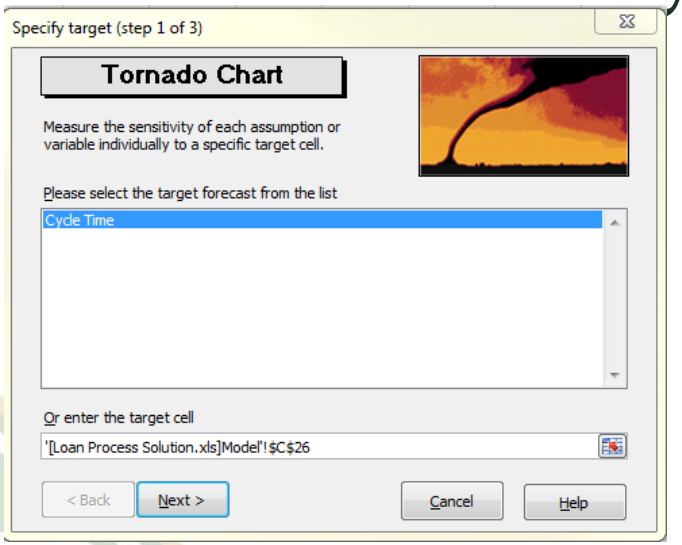
View the sensitivity results

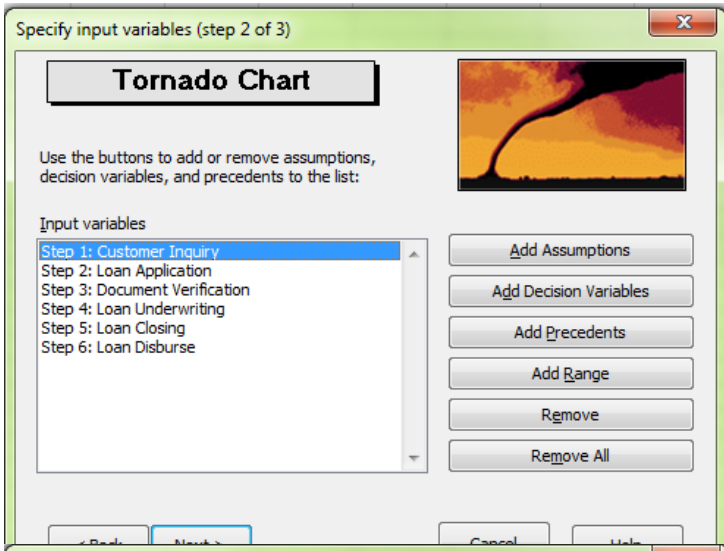
- View the sensitivity chart (from the forecast window… Forecast menu > Sensitivity chart)
- Which of the six steps most affects the variation of Cycle Time?
- Is one assumption dominant?

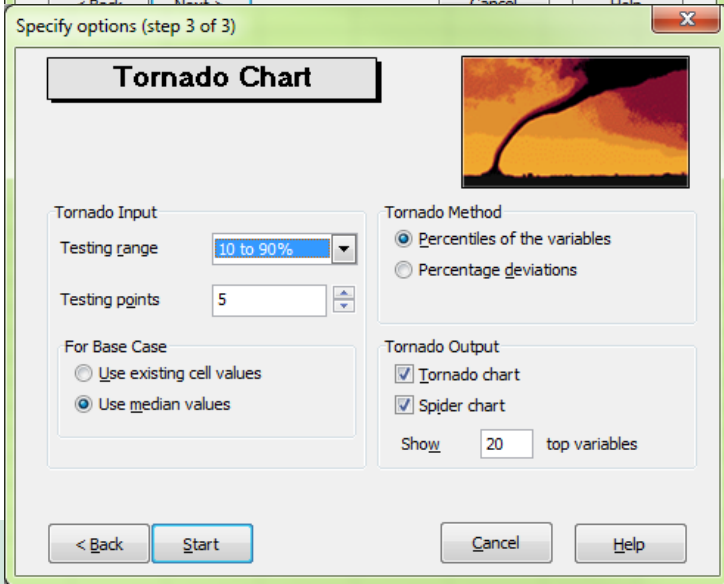


View the sensitivity results

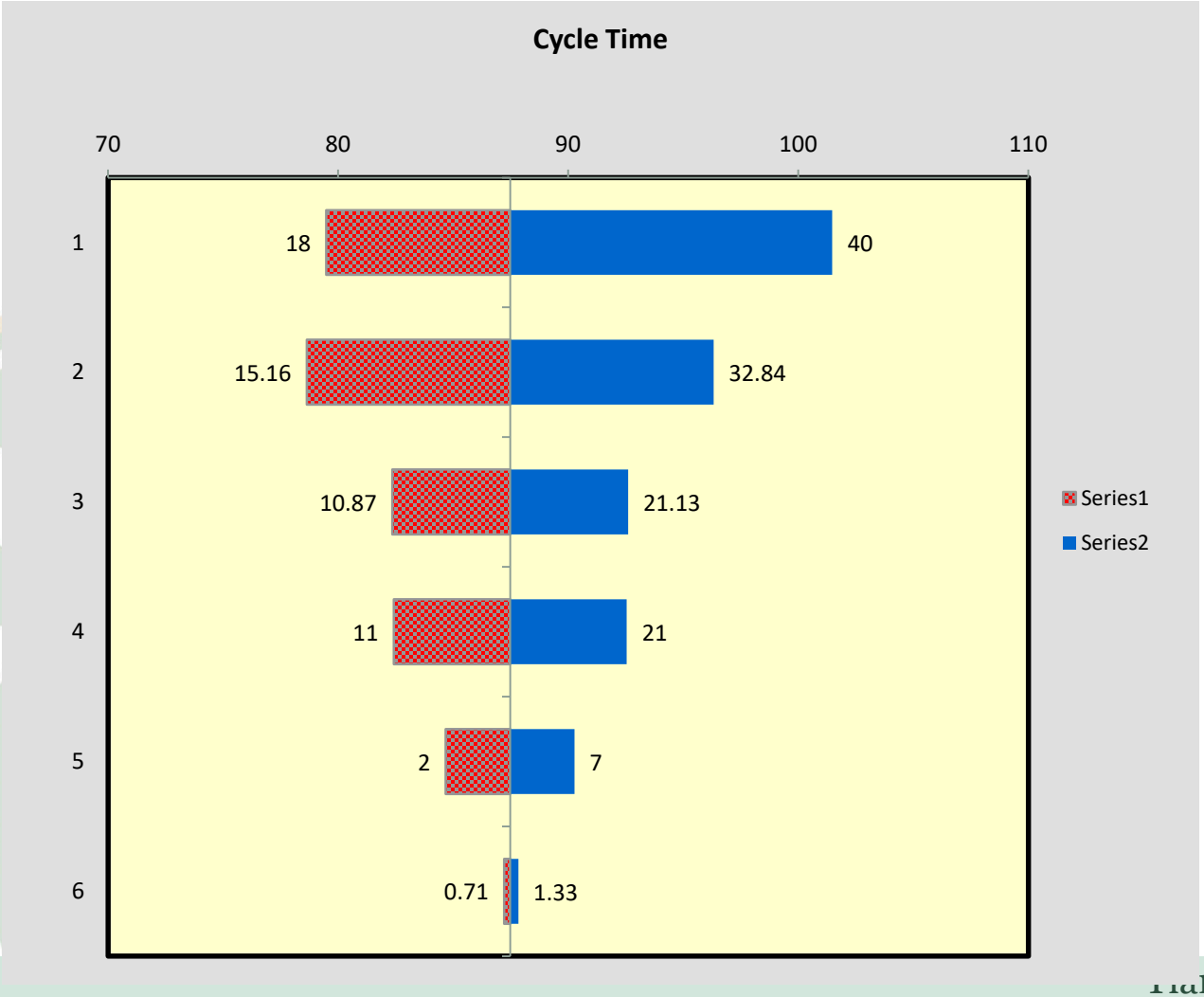






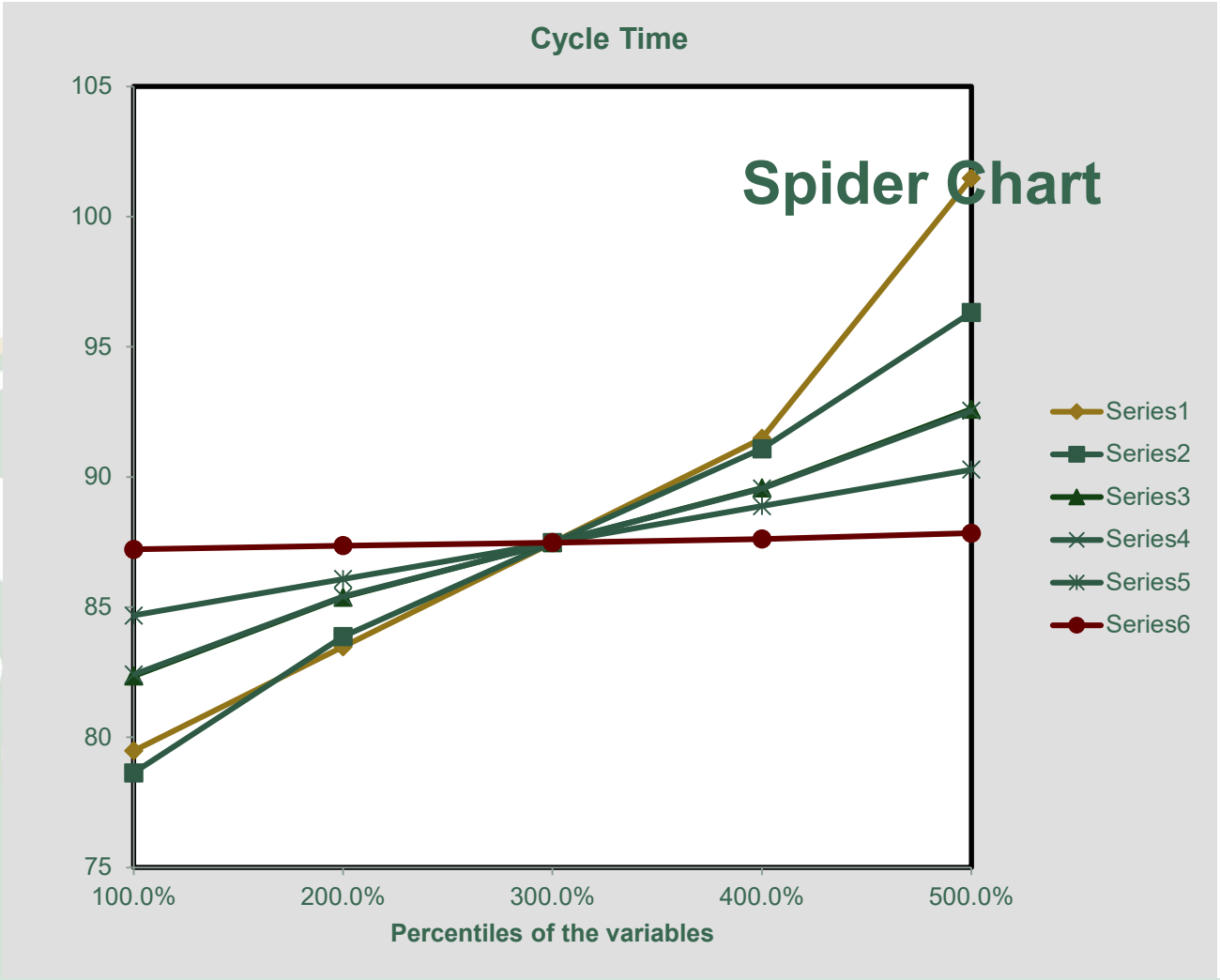


View the sensitivity results



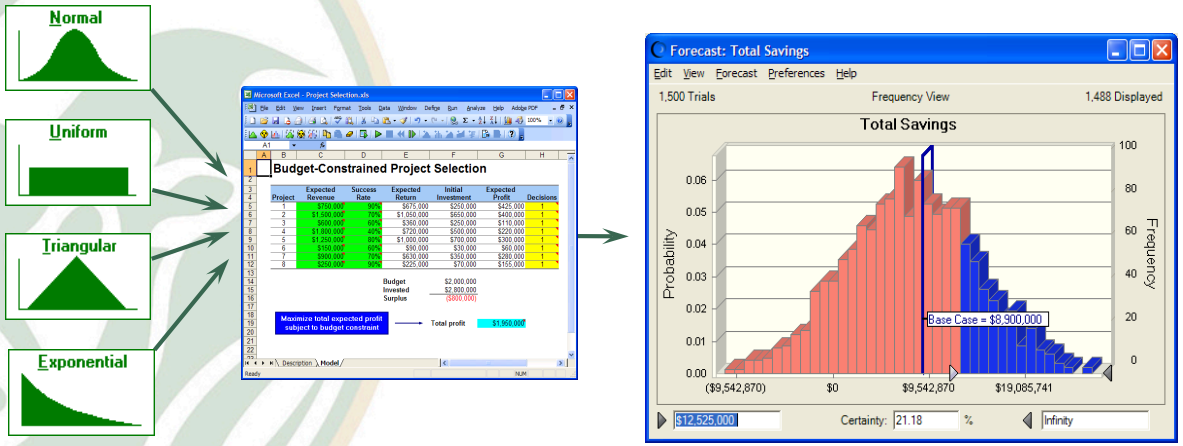
Tornado Chart

View the sensitivity results



Summary

- Traditional spreadsheets, using estimates or averages, do not account for the variability that often occurs in problems we try to model.
- Monte Carlo simulation with Crystal Ball allows you to use ranges of inputs to explore the range of possible outcomes and the probability of their occurrence.



Cartoon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FLIGHT SIMULATOR
search ID: mba0785


I'M AFRAID HE CAN'T COME TO THE PHONE, HE'S IN THE MIDDLE OF A MONTE CARLO SIMULATION
Deals Department
BRMM BRMM!
RALLY!
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