

One-Minute Spotlight

Oracle's Crystal Ball

How does Crystal Ball work?

Crystal Ball is an easy-to-use simulation program that helps you to analyze the risks and uncertainties associated with your Microsoft Excel spreadsheet models. This Spotlight is a quick overview of how Crystal Ball is used (it may take a little more than a minute!)

Excel models are **deterministic**, which means that the inputs are fixed (one value to one cell). You can only see one solution at a time. If you want to view alternative results, you need to manually change the inputs in the model.

Simulation is a way to quickly generate and analyze many possible results. Excel by itself cannot run simulations, so you need an add-in program like Crystal Ball to make Excel do this.

It Takes a Spreadsheet to Make a Model

Because Crystal Ball is an analysis tool, you can use it to simulate existing or new spreadsheets in any industry and for any application. For example, if you were a researcher in the pharmaceutical industry, you might develop the spreadsheet below to analyze the financial success of your project.

	A	B	C	E
1		ClearView Project		
2				
3		Costs (in millions):		
4		Development Cost of ClearView to Date	\$10.0	
5		Testing Costs	\$4.0	
6		Marketing Costs	\$16.0	
7		Total Costs	\$30.0	
8				
9		Drug Test (sample of 100 patients):		
10		Patients Cured	100	
11		FDA Approved if 20 or More Patients Cured	TRUE	
12				
13		Market Study (in millions):		
14		Persons in U.S. with Nearsightedness Today	40.0	
15		Growth Rate of Nearsightedness	2.00%	
16		Persons with Nearsightedness After One Year	40.8	
17				
18		Gross Profit on Dosages Sold:		
19		Market Penetration	8.00%	
20		Profit Per Customer in Dollars	\$12.00	
21		Gross Profit if Approved (MM)	\$39.2	
22				
23		Net Profit (MM)	\$9.2	
24				
25				
26				
27				
28				

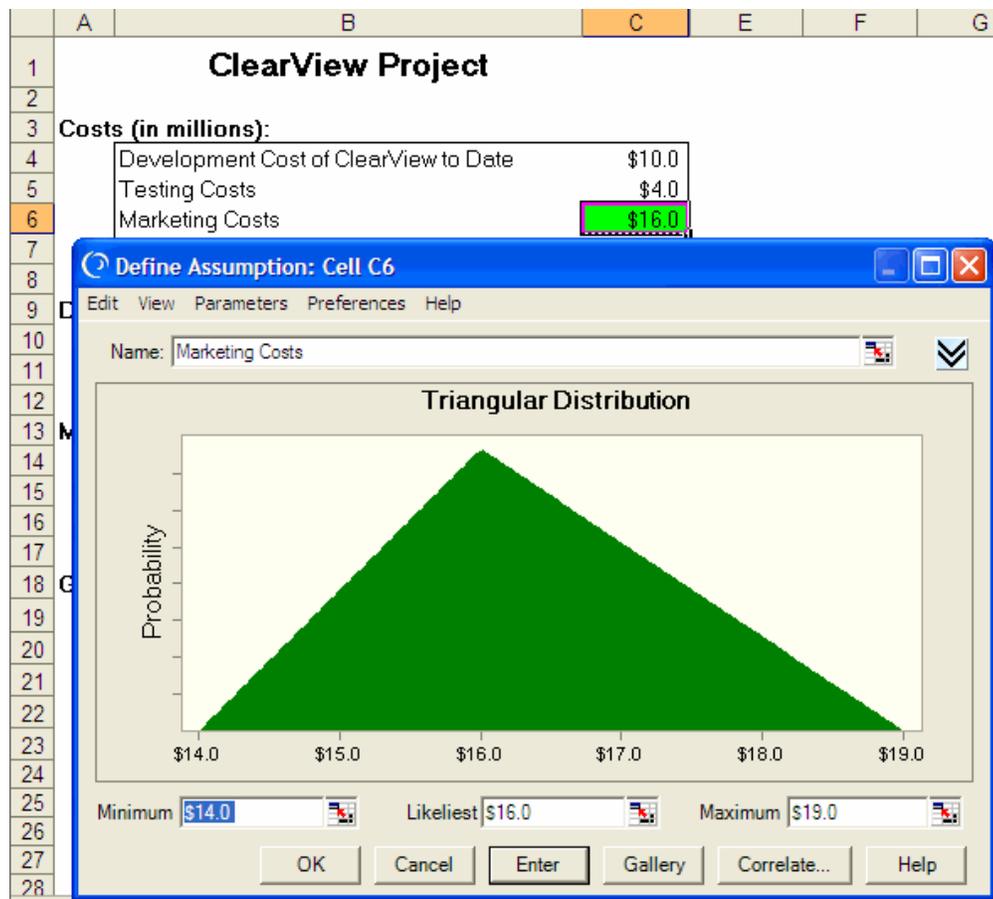
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Without simulation, you calculate a Net Profit of \$9,200,000. Not bad, but you have no sense of the likelihood of this result. Are you 75% sure this will happen? 100% sure? A simulation can show you the probability of a given outcome.

Identifying Uncertainty in Your Model and Defining Assumptions

The first step to using Crystal Ball is to determine which model inputs are uncertain. Which values are estimates? Which are averages? Once you have identified these, you use your knowledge of the uncertainty around the input to create a probability distribution for that cell (what we call an **assumption**). Crystal Ball lets you define these distributions.

In this case, you know Marketing Costs (cell C6) can vary between \$14,000,000 and \$19,000,000, but are most likely to be \$16,000,000. You then use Crystal Ball to define a Triangular distribution with these parameters, as shown below.



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The width of the triangle represents the range of possible costs, and the height of the triangle represents the likelihood of the value actually happening. The highest point of the triangle is \$16,000,000, the most likely value.

Identify Which Forecasts You Want to Analyze

The next step is to identify a **forecast**. A forecast is a formula cell that you want to measure and analyze. In this model, you select the Net Profit (cell C23).

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	E
1		ClearView Project		
2				
3		Costs (in millions):		
4		Development Cost of ClearView to Date	\$10.0	
5		Testing Costs	\$4.0	
6		Marketing Costs	\$16.0	
7		Total Costs	\$30.0	
8				
9		Drug Test (sample of 100 patients):		
10				
11				
12				
13		Market Penetration		
14				
15				
16				
17				
18		Gross Profit on Dosages Sold:		
19		Market Penetration	8.00%	
20		Profit Per Customer in Dollars	\$12.00	
21		Gross Profit if Approved (MM)	\$39.2	
22				
23		Net Profit (MM)	\$9.2	
24				

The 'Define Forecast: Cell C23' dialog box is open, showing:

- Name: Net Profit (MM)
- Units: (empty)
- Buttons: OK, Cancel, Help

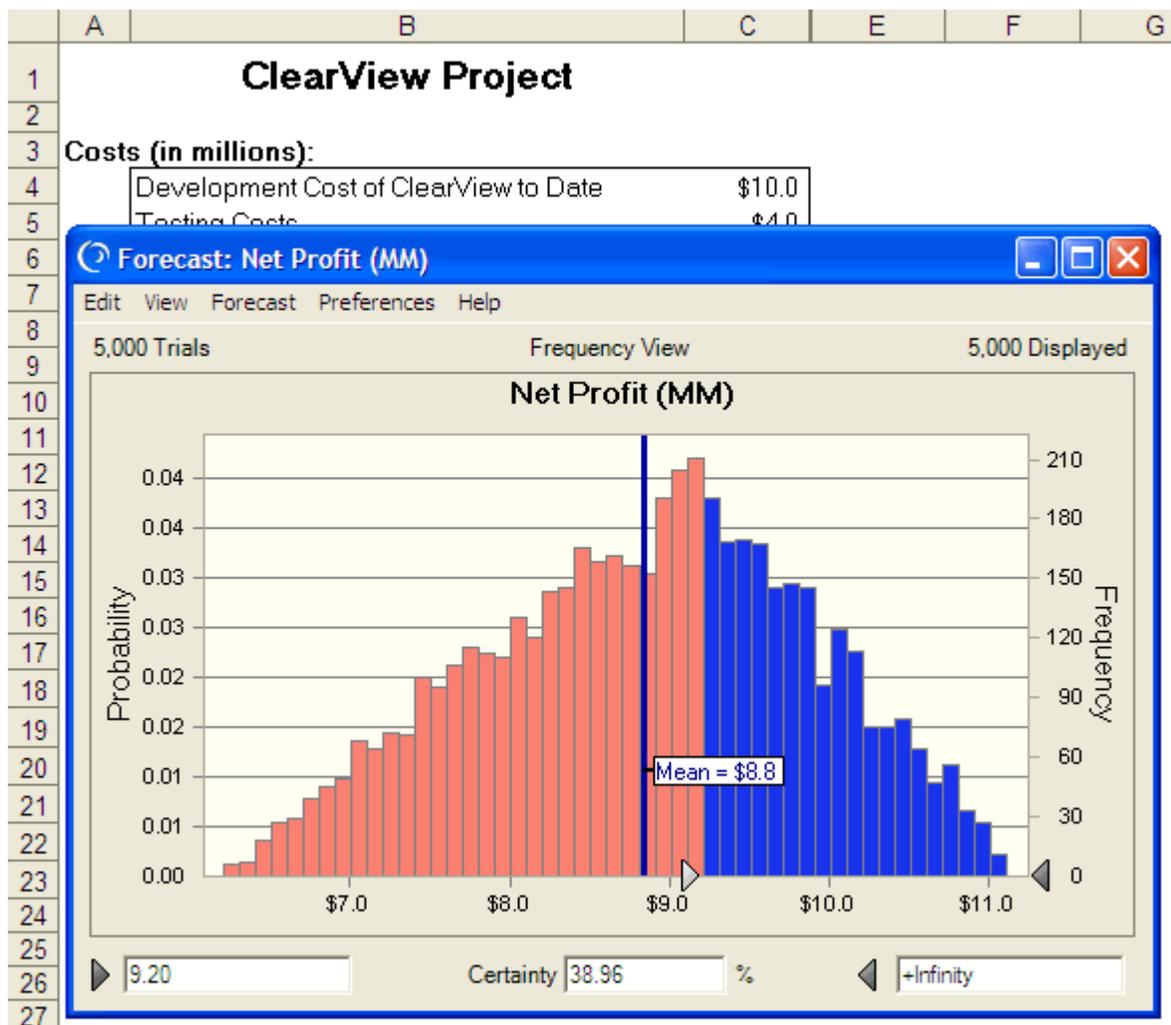
You can define multiple assumptions and forecasts. Once finished, you use the Crystal Ball command or toolbar icon to run a simulation. For each trial in this simulation, Crystal Ball enters a random value into the Marketing Cost cell based on the values you used to define the triangular distribution.

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For trial #1, the random value might be \$15,000,000, followed by \$17,500,000 for trial #2, \$16,875,000 for trial #3, and so on. Each time Crystal Ball enters a random value, it recalculates the spreadsheet and saves the forecast value in its memory for later analysis.

Analyzing Your Simulation Results

If you run a simulation for 5000 trials, then you have created 5000 forecasts (or possible outcomes), compared to the single outcome you started with in the deterministic spreadsheet. Simulation results are displayed in interactive histograms, or frequency charts. The chart below shows the results of 5000 trials of Net Profit. (**NOTE:** the number of trials here was chosen arbitrarily. To run a more accurate number of trials, you would use the Precision Control feature.)



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Notice that the range of possible Net Profit values is \$6,300,000 to \$11,100,000, with a mean (average) value of \$8,800,000. There is only a 38% certainty that you will receive a Net Profit of \$9,200,000 as you originally predicted.

Imagine how much more complex such simulations get with multiple assumptions, and **you begin to see the power of Crystal Ball.**

For more information or to contact us, browse to <http://www.oracle.com/crystalball>.