



DiscoverSim™
Discovery through Simulation

Getting Started

DMAIC Project Duration Example

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Getting Started Tutorial

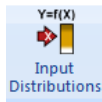
1. Open the workbook **DMAIC Project Duration** (By default this can be found in the DiscoverSim_Beta2 folder: **C:\Program Files (x86)\SigmaXL\DiscoverSim_Beta2**). This is an example model of a Six Sigma project with five phases: Define, Measure, Analyze, Improve and Control. We are interested in estimating the total project duration in days. Management requires that the project be completed in 120 days. We will model duration simply as:

Total Duration = Define + Measure + Analyze + Improve + Control

	A	B	C	D	E	F	G	H	
1	DiscoverSim Tutorial: Six Sigma DMAIC Project Expected Duration								
2							Triangular Distribution		
3		Project Phase:	DiscoverSim Input:				Minimum	Mode (Most Likely)	Maximum
4		Define					5	10	15
5		Measure					10	20	30
6		Analyze					5	10	15
7		Improve					10	20	30
8		Control					15	30	45
9									
10			DiscoverSim Output:						
11		Total Duration (days):	0				45	90	135
12									
13		Management Requirement (days):	120						

2. We will model each phase using a Triangular Distribution, which is popular when data or theory are not available to estimate or identify the distribution type and parameter values. (Another similar distribution that is commonly used for project management is PERT). The Minimum, Mode (Most Likely) and Maximum durations were estimated by the Six Sigma project team based on their experience.

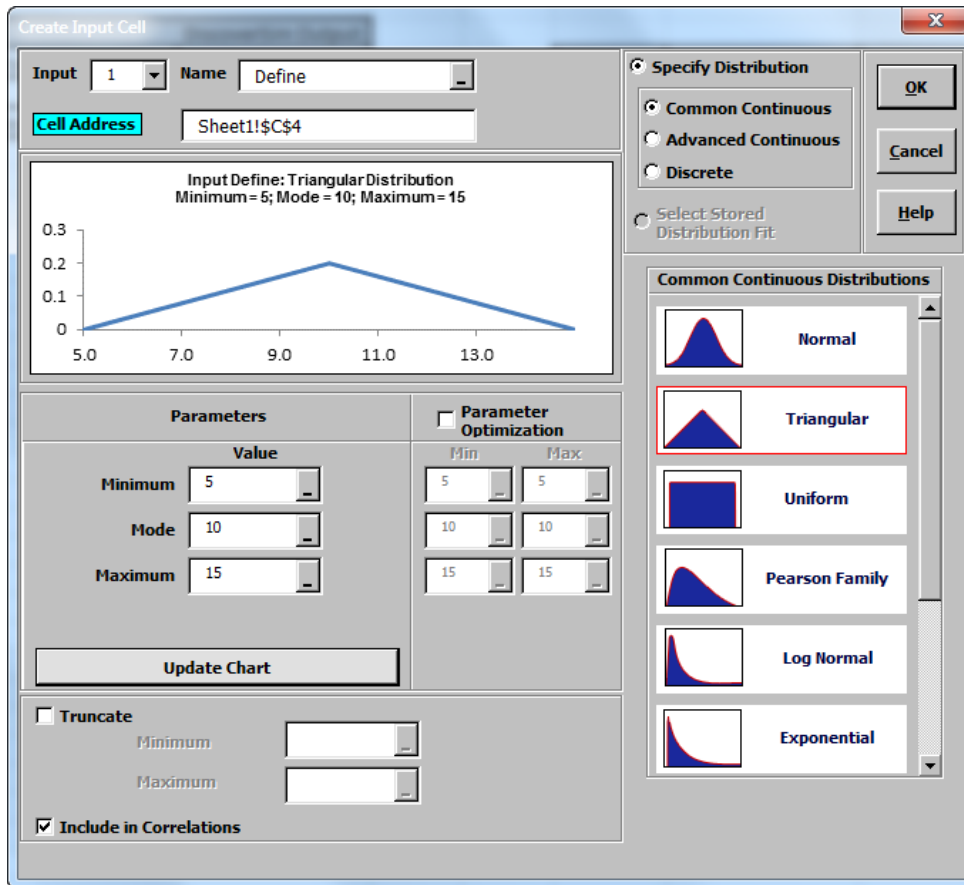
3. Click on cell **C4** to specify the Input Distribution for Define. Select **DiscoverSim > Input Distributions:**



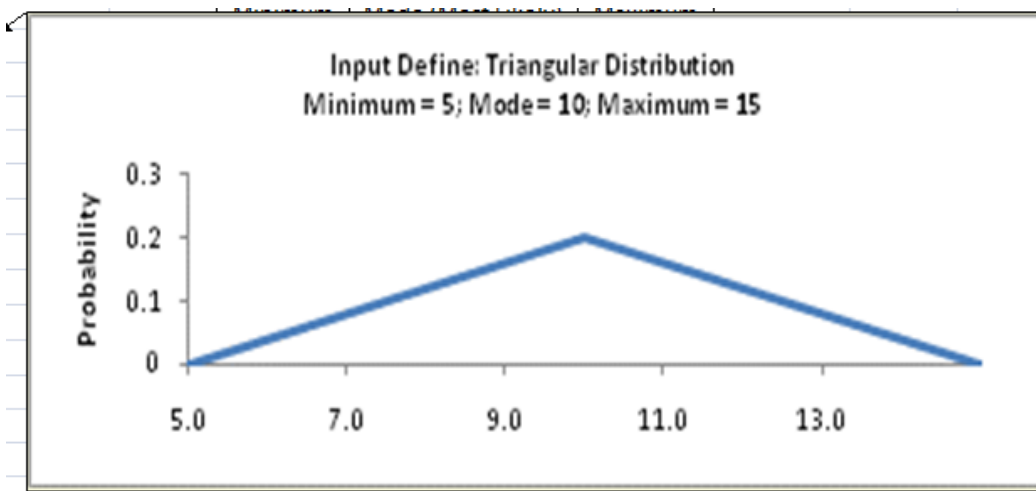
4. Select **Triangular Distribution**.
5. Click input name cell reference and specify cell **B4** containing the input name “Define”.
6. Click the **Minimum** parameter cell reference and specify cell **F4** containing the minimum parameter value = 5.
7. Click the **Mode** parameter cell reference and specify cell **G4** containing the mode (most likely) parameter value = 10.
8. Click the **Maximum** parameter cell reference and specify cell **H4** containing the maximum

parameter value = 15.

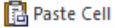
9. Click **Update Chart** to view the triangular distribution as shown:



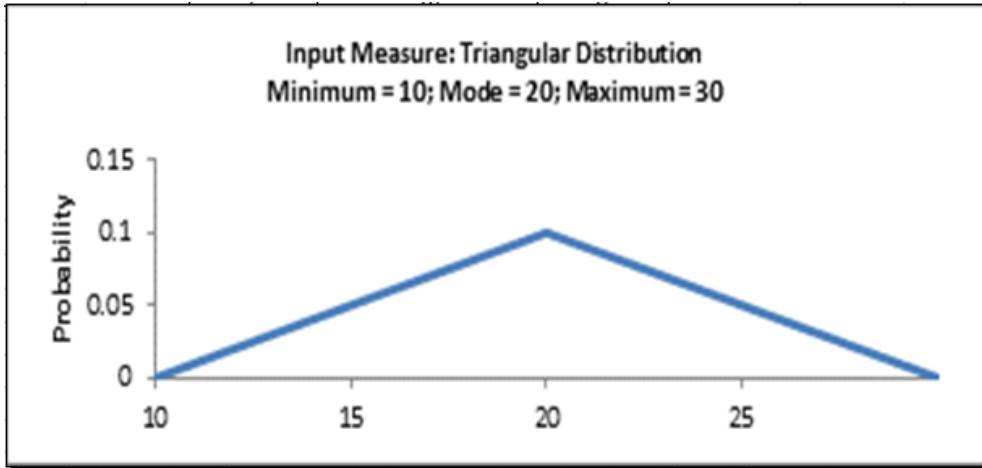
10. Click **OK**. Hover the cursor on cell **C4** to view the DiscoverSim graphical comment showing the distribution and parameter values:



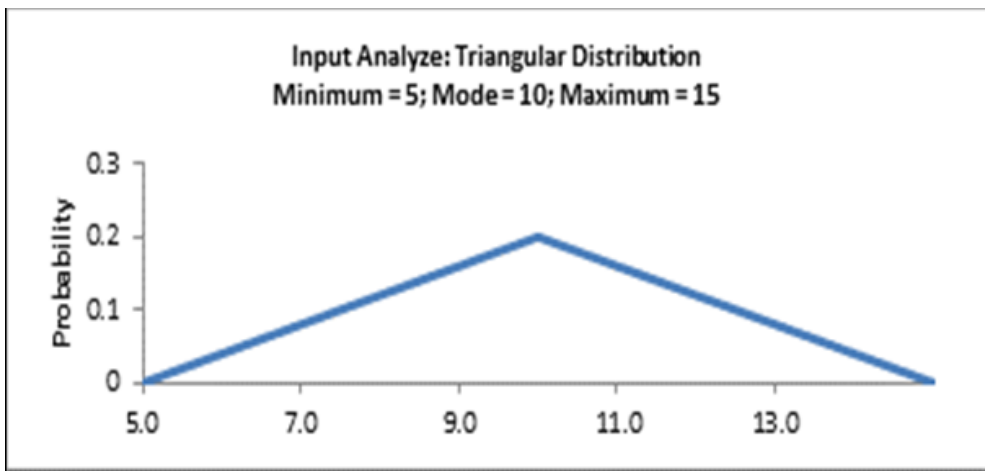
11. Click on cell **C4**. Click the DiscoverSim Copy Cell menu button  Copy Cell (Do not use Excel's Copy – it will not work!).

12. Select cells **C5:C8**. Click the DiscoverSim Paste Cell menu button  (Do not use Excel's Paste – it will not work!).

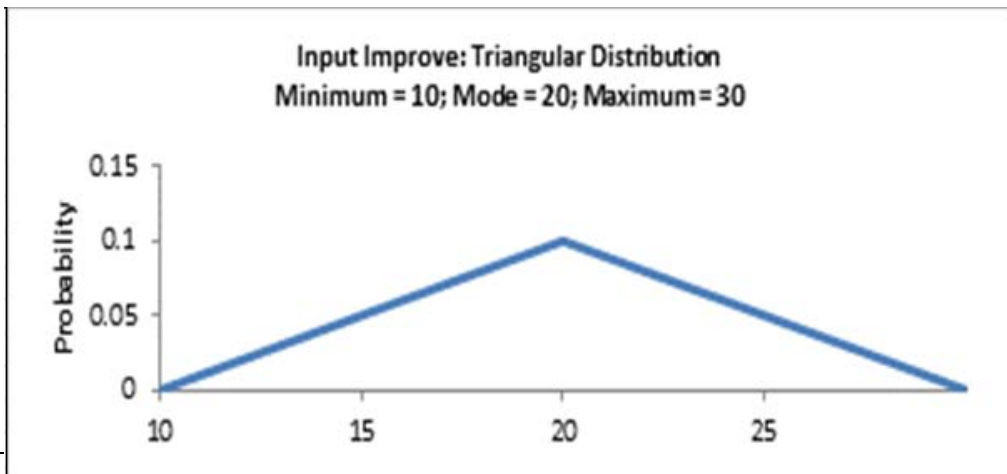
13. Verify that the input comments appear as shown:
Cell C5:



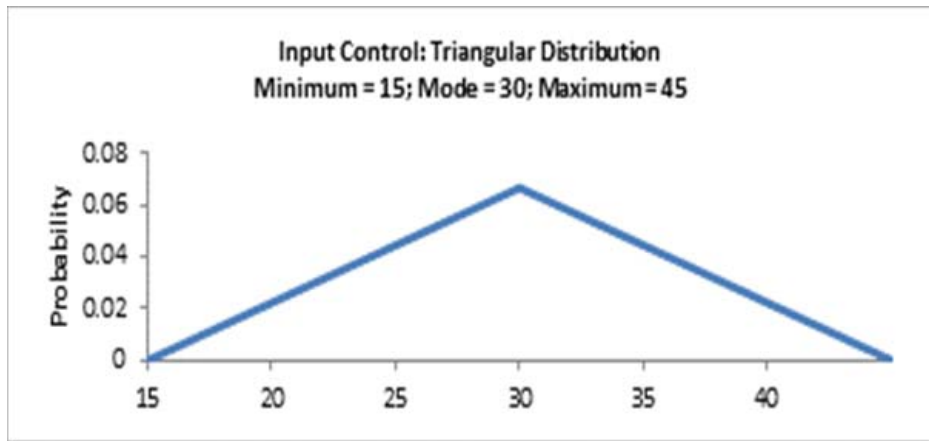
Cell C6:



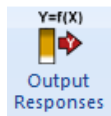
Cell C7:



Cell C8:



14. Click on cell C11. Note that the Excel formula =SUM(C4:C8) has already been entered. Select **DiscoverSim > Output Responses:**



15. Enter the output **Name** as “Total”. Enter the Upper Specification Limit (**USL**) as 120 (or specify cell reference C13).

Create/Edit Output

Output: 1 Name: Total

Cell Address: [DiscoverSim DMAIC Project Duration]

Function: =SUM(C4:C8)

LSL: Target: USL: 120

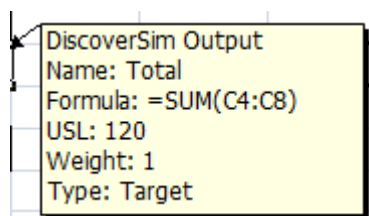
Optimization Settings (Optional)

Weight: 1 Goal: Target

Buttons: OK, Cancel, Help

Click **OK**.

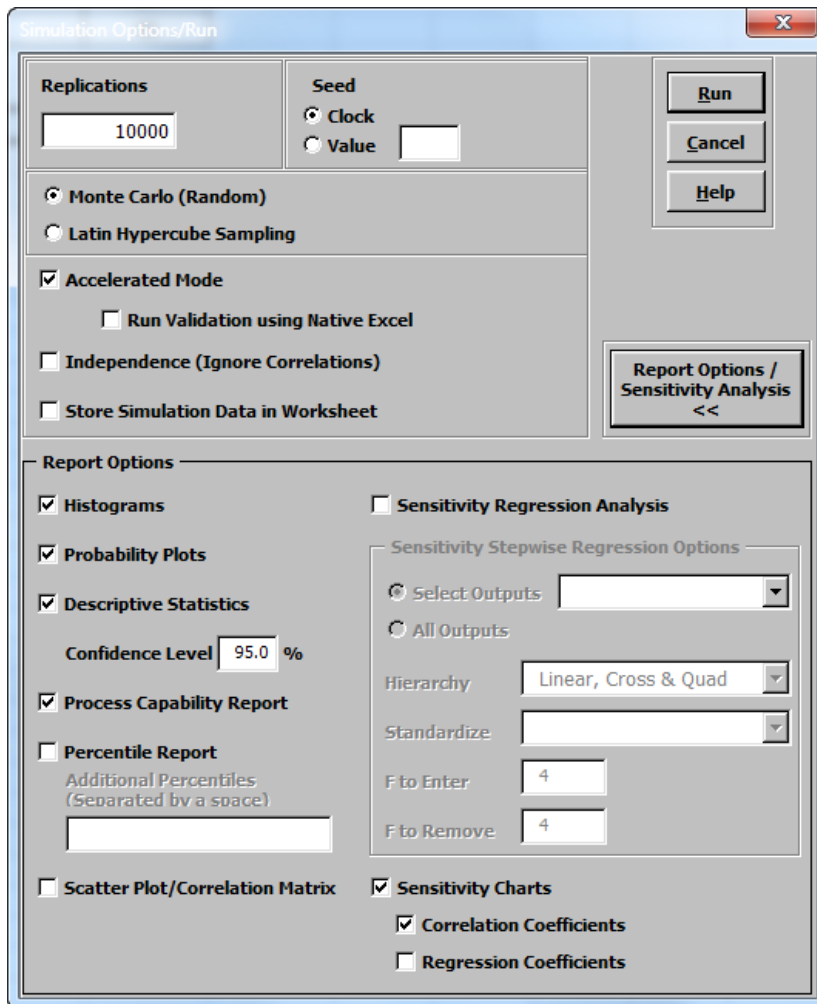
16. Hover the cursor on cell C11 to view the DiscoverSim Output information.



17. Select **DiscoverSim > Run Simulation:**

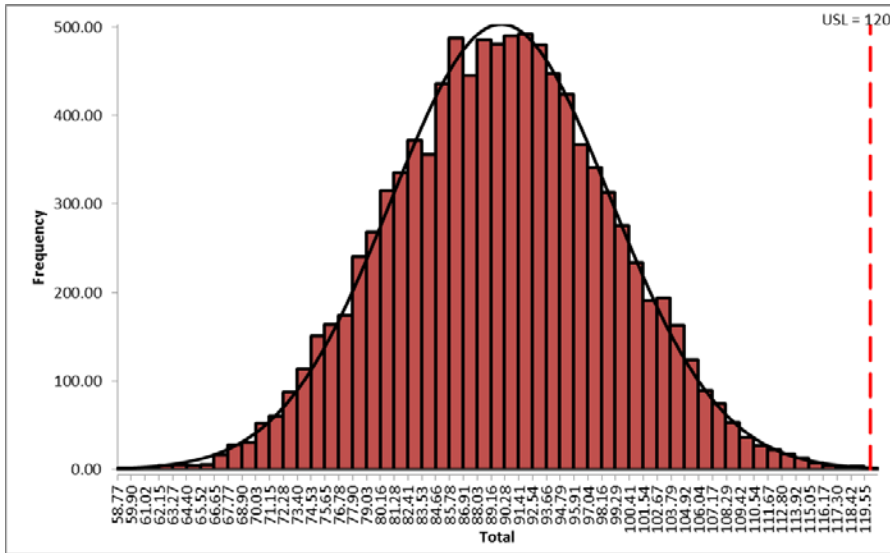


18. Click **Report Options/Sensitivity Analysis**. Check Sensitivity Charts and Correlation Coefficients as shown:



Click **Run**.

19. The DiscoverSim output report shows a histogram, descriptive statistics and process capability indices:



Output 1 Model Information	
Cell Address	Total
Function	=SUM(C4:C8)
USL	120
Target	
LSL	
Weight	1
Goal	

Descriptive Statistics	
Count	10000
Mean	90.111
StDev	8.959414
Range	64.557
Minimum	59.823
25th Percentile (Q1)	84.080
50th Percentile (Median)	90.139
75th Percentile (Q3)	96.262
Maximum	124.380
95.0% CI Mean	89.93564572 to 90.28689
95.0% CI Median	89.91574896 to 90.34961
95.0% CI StDev	8.836949366 to 9.085344

Normality Tests	
Anderson-Darling Normality Test	0.358861
p-value (A-D Test)	0.4513
Skewness	0.001925599
p-value (Skewness)	0.9373
Kurtosis	-0.119965
p-value (Kurtosis)	0.0097

Process Capability Indices	
Pp	
Ppu	1.11
Ppl	
Ppk	1.11
Cpm	

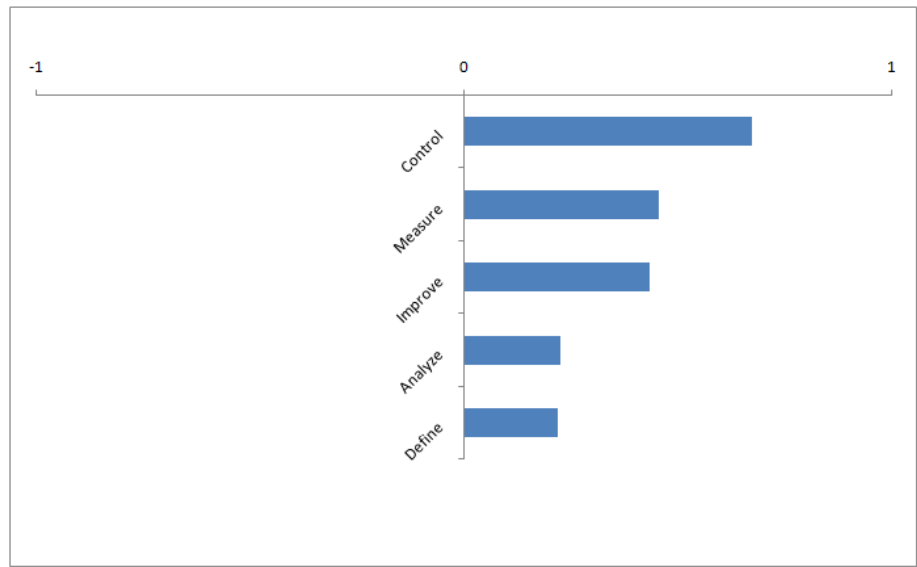
Expected Overall Performance (Assuming Normal Distribution)	
ppm > USL	424.94
ppm < LSL	
ppm Total	424.94
% > USL	0.04
% < LSL	
% Total	0.04

Actual Performance (Empirical)	
ppm > USL	300.00
ppm < LSL	
ppm Total	300.00
% > USL	0.03
% < LSL	
% Total	0.03

From the histogram and capability report we see that the Total Project duration should easily meet the requirement of 120 days, assuming that our model is valid. The likelihood of failure (based on the actual simulation performance) is .03%.

20. If we needed to improve the performance, the sensitivity charts would guide us where to focus our efforts. Click on the **Sensitivity Chart** sheet:

Inputs	Spearman Rank
Control	0.671985695
Measure	0.453811627
Improve	0.431905793
Analyze	0.225288333
Define	0.218393731



The control phase is the dominant input factor affecting Total Duration, followed by Measure and Improve.

This Sensitivity Chart uses the Spearman Rank Correlation, and the results may be positive or negative. If you wish to view R-Squared percent contribution to variation, rerun the simulation with Sensitivity Regression Analysis and Sensitivity Charts, Regression Coefficients checked.

Note: The results in this simple example are intuitively obvious from the input values, but keep in mind that a real model will likely be considerably more complex with sensitivity analysis results identifying important factors that one might not have expected.