JavaScript Simulation
by
Prof. Richard B. Goldstein

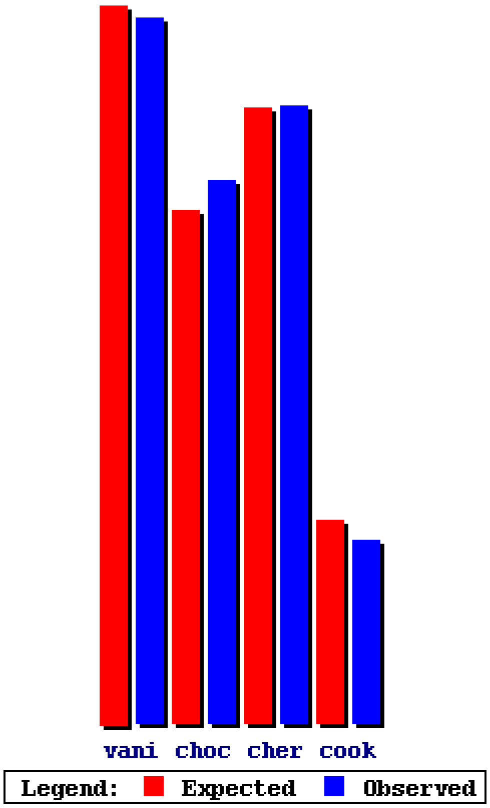
Instructions:
[1] For each bin needed fill in a value or name (optional) and an expected frequency.

[2] Enter the number of simulations
[3] Press "clear" or "run"
[4] You may change the number of simulations and "run" again

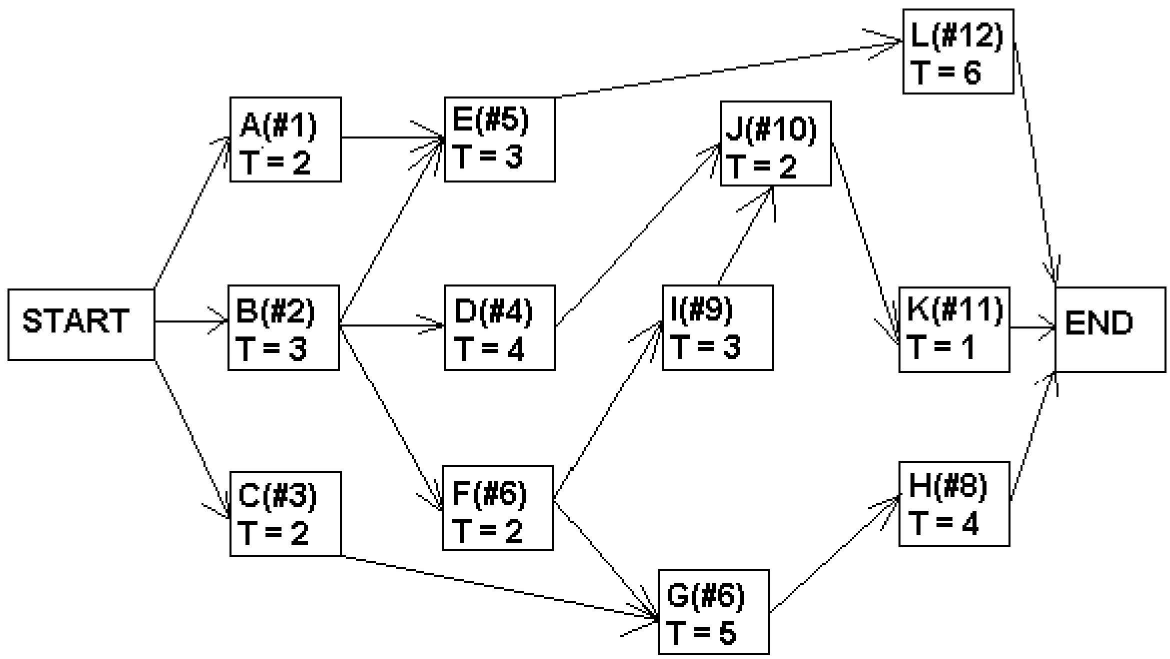
	<=== Input ===>		<=== Output ===>		
Bin	**Value**	**Expected Frequency**	**Expected Probability**	**Observed Frequency**	**Observed Probability**
#1	vanilla	7	0.35	344	0.344
#2	chocolate	5	0.25	265	0.265
#3	cherry garcia	6	0.3	301	0.301
#4	cookie dough	2	0.1	90	0.09
#5					
#6					
#7					
#8					
#9					
#10					
#11					
#12					
#13					
#14					
#15					
#16					
#17					
#18					
	Totals:	20	1.000	1000	1.000

# of simulations: 1000

clear table run simulation


vani choc cher cook
Legend: Expected Observed

PERT/CPM SIMULATION - **Prof. Richard B. Goldstein**



PATH	ACTIVITIES	EXPECTED TIME	
#1	A-E-L or 1-5-12	2 + 3 + 6	= 11
#2	B-E-L or 2-5-12	3 + 3 + 6	= 12
#3	B-D-J-K or 2-4-10-11	3 + 4 + 2 + 1	= 10
#4	B-F-I-J-K or 2-6-9-10-11	3 + 2 + 3 + 2 + 1	= 11
#5	B-F-G-H or 2-6-7-8	3 + 2 + 5 + 4	= 14
#6	C-G-H or 3-7-8	2 + 5 + 4	= 12

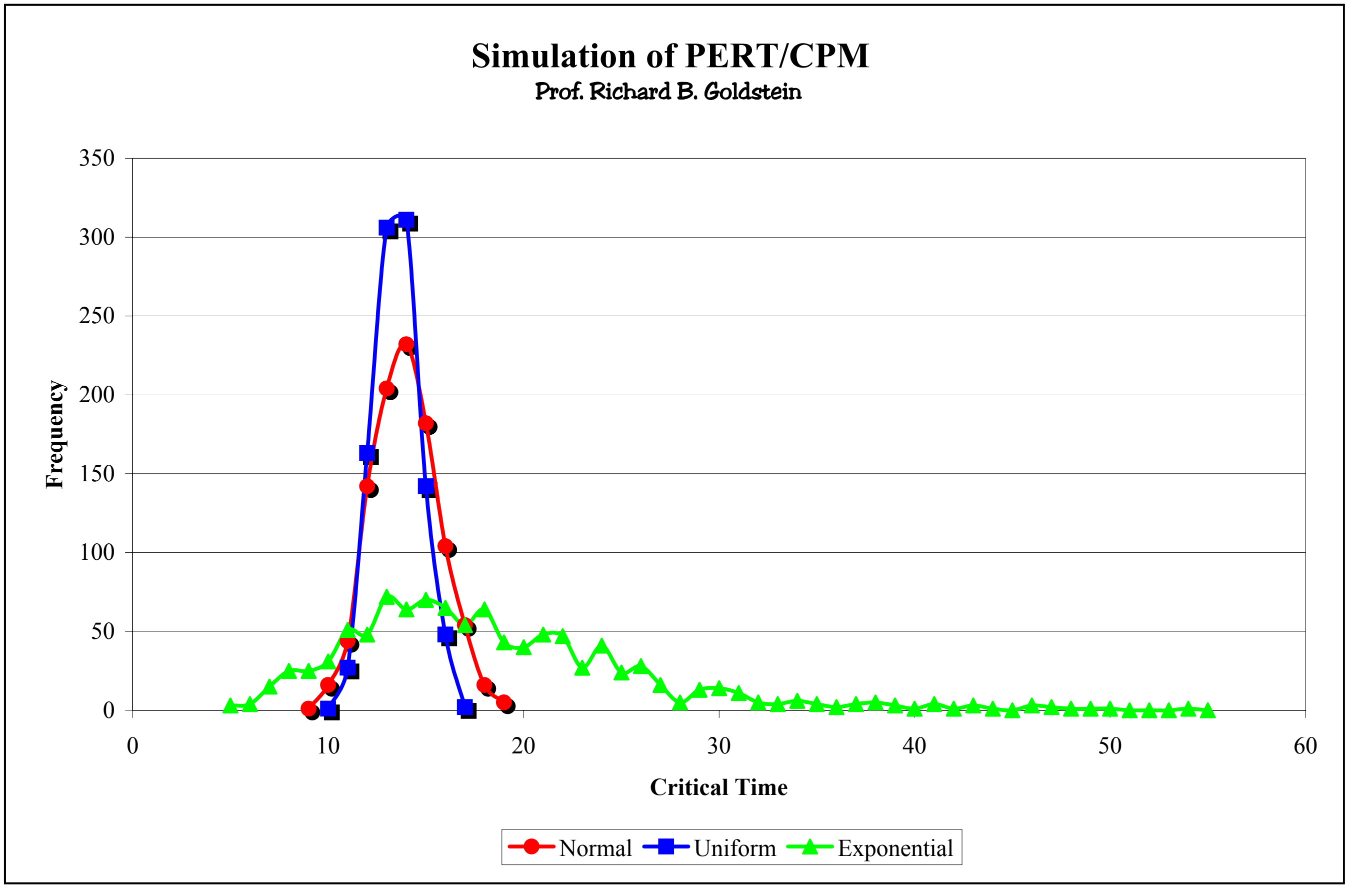
Frequency of being the Critical Path

Path	NORMAL N(μ,1)	UNIFORM U(μ - 1,μ + 1)	EXPONENTIAL (μ)
#1	6.0%	1.1%	12.2%
#2	12.9%	5.9%	16.2%
#3	1.7%	0.1%	12.6%
#4	5.4%	0.5%	17.6%
#5	71.2%	92.4%	32.4%
#6	2.8%	0.0%	9.0%

Critical Time

	NORMAL N(μ,1)	UNIFORM U(μ - 1,μ + 1)	EXPONENTIAL (μ)
Mean	14.442	14.016	18.805
St. Dev.	1.677	1.122	7.419

Frequency	Normal	Uniform	Exponential
5			3
6			4
7			15
8			25
9	1		25
10	16	1	31
11	44	27	51
12	142	163	48
13	204	306	72
14	232	311	64
15	182	142	70
16	104	48	65
17	54	2	54
18	16		64
19	5		43
20			40
21			48
22			47
23			27
24			41
25			24
26			28
27			16
28			5
29			13
30			14
31			11
32			5
33			4
34			6
35			4
36			2
37			4
38			5
39			3
40			1
41			4
42			1
43			3
44			1
45			0
46			3
47			2
48			1
49			1
50			1
51			0
52			0
53			0
54			1
55			0
	1000	1000	1000

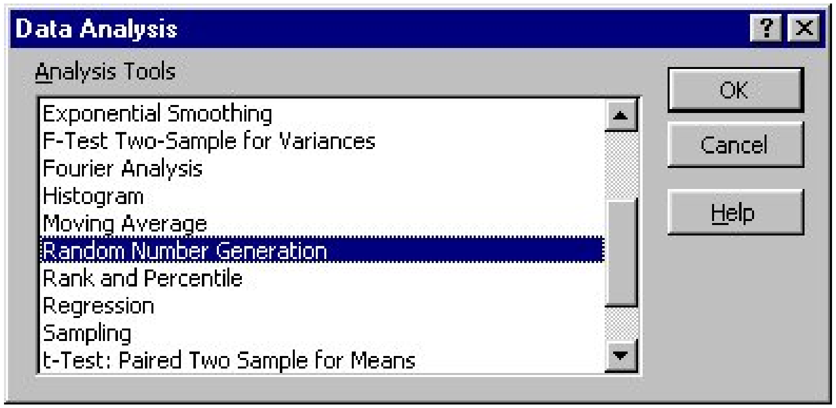


Random Number Generation

The random number generation tool generates random numbers according to some selected parameters. Actually, it generates pseudo-random numbers, because a perfect random number generator has not yet been invented or discovered.

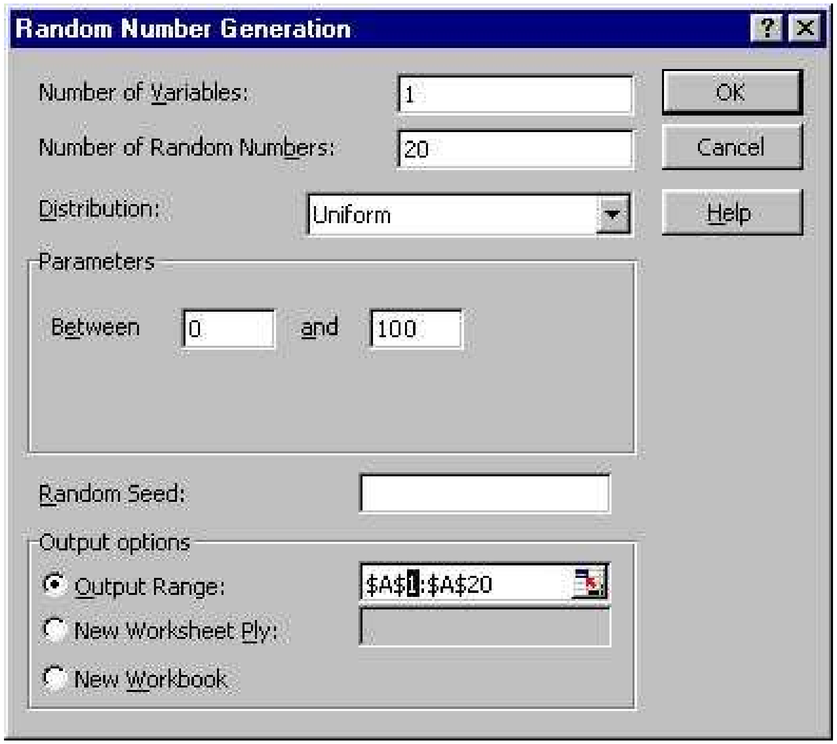
This analysis tool fills a range with independent random numbers drawn from one of seven selected distributions. You can characterize subjects in a population with a probability distribution. The types are explained below. For example, you might use a normal distribution to characterize the population of individuals' heights. The normal distribution has a classic bell shape curve and is used to describe many phenomena that have a measure which is continuous. You might use a binomial distribution to characterize the probability of outcomes of coin-flips. That is, for an honest coin, the probability of a head or a tail is 0.5.

From Data Analysis menu, you can choose Random Number Generation and Click OK.



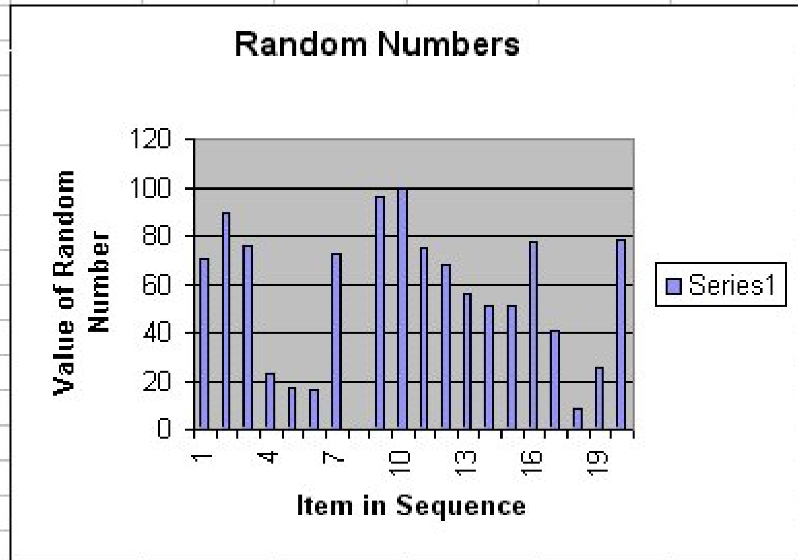
The Random Number Generation dialog box is shown in the figure below:

In our example, we want to create a column of 20 random numbers with their values ranging between 0 and 100. We can specify these values in the Random Number Generation dialog box. For this example, we will choose a Uniform distribution for these numbers. In the Output options, one must select the cells into which the results will be written.



The results are shown below. The generated values are written in the cells A1:A20. The data can also be plotted as shown

	A
1	70.93417
2	89.21476
3	75.93005
4	22.71798
5	16.75161
6	15.76281
7	72.42653
8	0.277718
9	96.39882
10	99.4293
11	74.91989
12	68.46828
13	56.41652
14	50.81332
15	50.84994
16	77.16605
17	40.57436
18	8.389538
19	25.48296
20	78.5577
21	
22	



About the Random Number Generation dialog box

Number of Variables: The number of columns of values you want in the output table. If you do not enter a number, EXCEL fills all columns in the output range you specify.

Number of Random Numbers: This is to enter the number of data points you want to see. Each data point appears in a row of the output table. If you do not enter a number, EXCEL fills all rows in the output range you specify.

Distribution: Choose the distribution method you want to use to create random values.

Uniform: This is characterized by lower and upper bounds. Variables are drawn with equal probability from all values in the range. A common application uses a uniform distribution in the range 0…1.

Normal: This is characterized by a mean and a standard deviation. A common application uses a mean of 0 and a standard deviation of 1 for the standard normal distribution. This is also known as a Gaussian distribution.

Bernoulli: This is characterized by a probability of success (p-value) on a given trial. Bernoulli random variables have the value 0 or 1. For example, you can draw a uniform random variable in the range 0---1. If the variable is less than or equal to the probability of success, the Bernoulli random variable is assigned the value 1,otherwise, it is assigned the value 0.

Binomial: This is characterized by a probability of success (p-value) for a number of trials. For example, you can generate number-of-trials Bernoulli random variables, the sum of which is a binomial random variable.

Poisson: This is characterized by a value l (lambda), equal to 1/mean. The Poisson distribution is often used to characterize the number of events that occur per unit of time. This distribution can describe discrete, rare, physical events that occur in an interval of time or space. A practical measure of rare events is that, in at least 50 trials, the number of trials times the probability of an event occurring is less than about 5. For examples, the average rate at which electrons arrive at a collector or the average rate of counts by a Geiger counter can often be described by a Poisson distribution.

Patterned: This is characterized by a lower and upper bound, a step, repetition rate for values, and repetition rate for the sequence.

Discrete: This is characterized by a value and the associated probability range. The range must contain two columns: The left column contains values, and the right column contains probabilities associated with the value in that row. The sum of the probabilities must be 1.

Parameters: Enter a value or values to characterize the distribution selected.

Random Seed: Enter an optional value from which to generate random numbers. You can reuse this value later to produce the same random numbers.

Output Range: Enter the reference for the upper-left cell of the output table. Microsoft Excel automatically determines the size of the output area and displays a message if the output table will replace existing data.

New Worksheet Ply: Click to insert a new worksheet in the current workbook and paste the results starting at cell A I of the new worksheet. Type a name in the box, if desired.

New Workbook: Click to create a new workbook and paste the results on a new worksheet in the new workbook.

Return to Module 7: Spreadsheets and Some Excel Functions