Alpha Version 1.0

This File can be obtained from: https://drive.google.com/open?id=0BxnTE2i_gax8c0pFZlFHajJpWWs

Simulating financial outcomes with Excel

This spreadsheet demonstrates how you can run simulations with Excel. There are addins available that can do a lot more than this spreadsheet, however the price is right for this one.

The first two sheets (Example 1 and 2) show you how to create distribution of the variables that you want to simulate. It demonstrates two ways to do this. Either by using a built distribution (there quite a number) directly or by using a lookup function to find the appropriate values. Both use the probablity of an event to compute the outcome associated with the probablility.

The third sheet (Analysis) uses a two custom functions and lookups to create a free cash flow statement. In addition it also calculates a single probability of a lawsuit. The last sheet (Result) is used to simulate the IRR of the cash flows given a distribution of market share and price. Look at the formula in Z23 which computes the IRR if one exists, if one does not it set a code (-2) and it also check to make sure we did not lose the lawsuit.

In the random number generation the ABS() function is used to insure that the random number is positive. This was done because the current release of Excel 2003 can at times generate a negative number. There is an explanation and a hotfix for it at the links given below. If you know that you do not have this problem you can remove the ABS() functions, this will spend up the process somewhat. Also if you remove the example sheets (1 and 2) this will also speed up the simulation since all are recalculate everytime the simulation is run.

Random Number information:

http://support.microsoft.com/default.aspx?kbid=834520

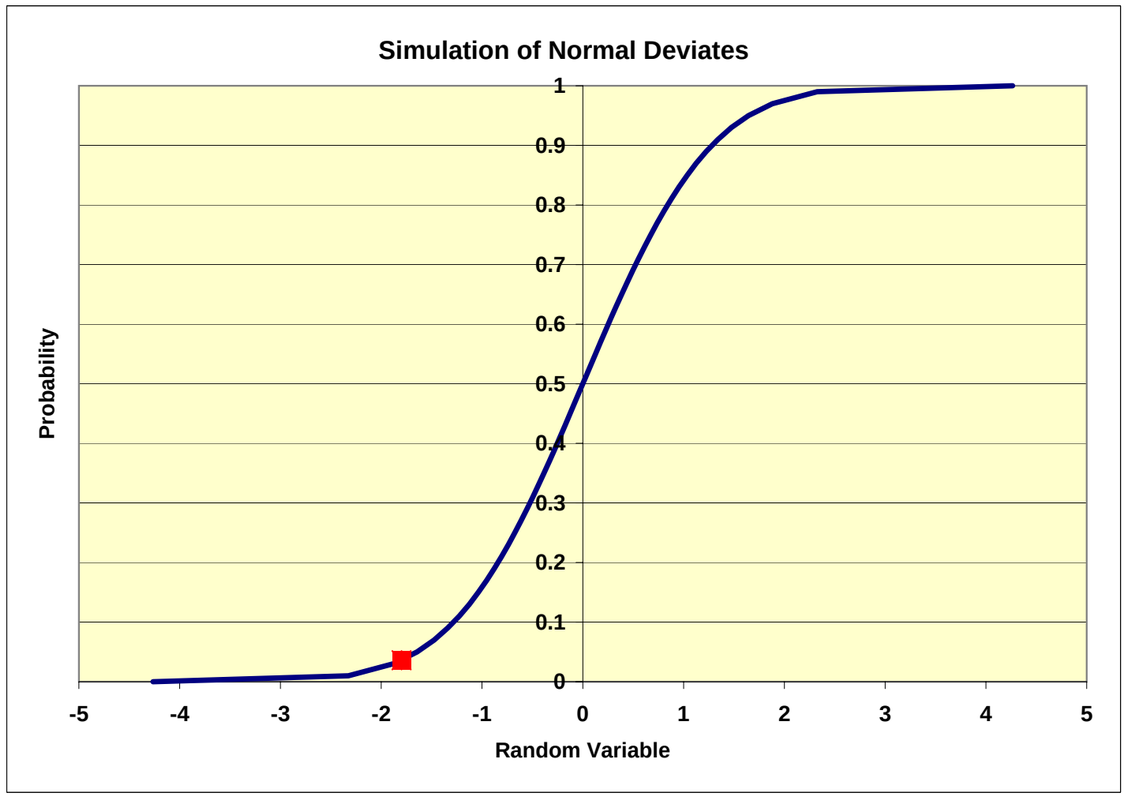
http://support.microsoft.com/default.aspx?scid=kb;en-us;833855

You can see the results by pushing F9 (in fact anything you do that involves a recalculation will simulate)

This would simulate outcomes from the Standard Normal Distribution

Random Number	Deviate	
0.036025249	-1.7987989	<=== =NORMSINV(K5)

This example is the easiest since it just uses the built in normal density functions



0.02	
1E-05	-4.265
0.01	-2.326
0.03	-1.881
0.05	-1.645
0.07	-1.476
0.09	-1.341
0.11	-1.227
0.13	-1.126
0.15	-1.036
0.17	-0.954
0.19	-0.878
0.21	-0.806
0.23	-0.739
0.25	-0.674
0.27	-0.613
0.29	-0.553
0.31	-0.496
0.33	-0.44
0.35	-0.385
0.37	-0.332
0.39	-0.279
0.41	-0.228
0.43	-0.176
0.45	-0.126
0.47	-0.075
0.49	-0.025
0.51	0.025
0.53	0.075
0.55	0.126
0.57	0.176
0.59	0.228
0.61	0.279
0.63	0.332
0.65	0.385
0.67	0.44
0.69	0.496
0.71	0.553
0.73	0.613
0.75	0.674
0.77	0.739
0.79	0.806
0.81	0.878
0.83	0.954
0.85	1.036
0.87	1.126
0.89	1.227
0.91	1.341
0.93	1.476
0.95	1.645
0.97	1.881
0.99	2.326
1	4.265

You can see the results by pushing F9

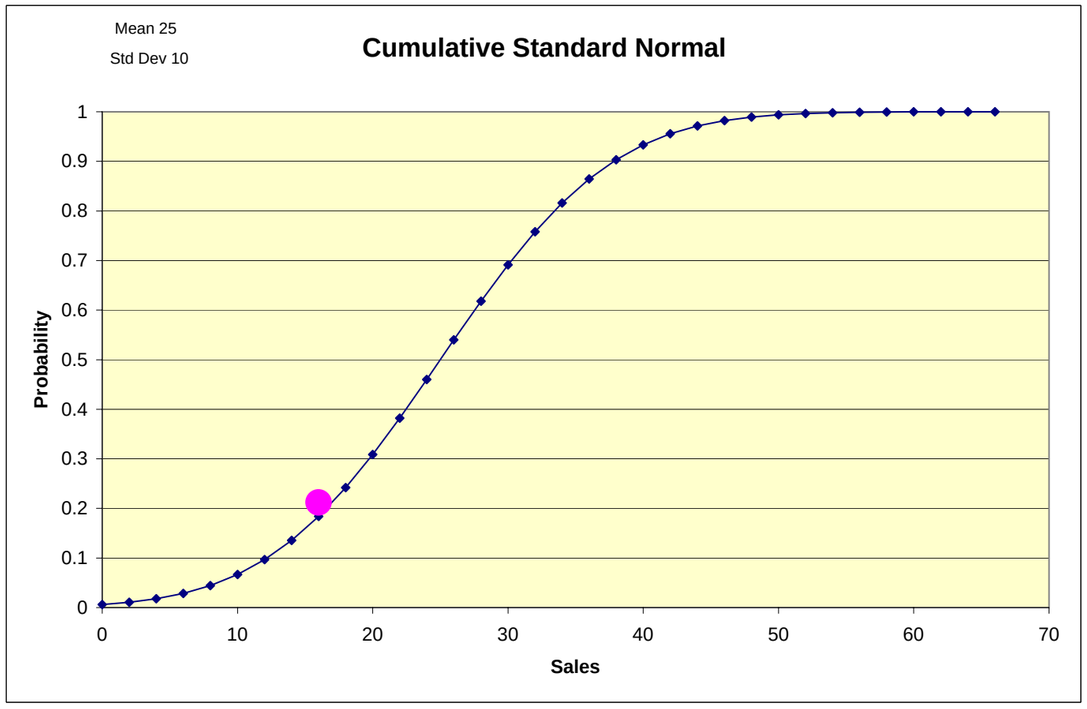
Mean 25 **Rand Number** **Units Sold**
Std Dev 10 **0.211742282** **16** <===

This example uses normal density function but looks up the value use Vlookup

=VLOOKUP(H7,C11:D44,2,TRUE)

2

		Mean	25
50		Std Dev	10
0	0.398942	0.006209665	0
2	0.053991	0.01072411	2
4	0.000134	0.017864421	4
6	6.08E-09	0.02871656	6
8	5.05E-15	0.044565463	8
10	7.69E-23	0.066807201	10
12	2.15E-32	0.096800485	12
14	1.1E-43	0.135666061	14
16	1.03E-56	0.184060125	16
18	1.76E-71	0.241963652	18
20	5.52E-88	0.308537539	20
22	3.2E-106	0.382088578	22
24	3.3E-126	0.460172163	24
26	6.4E-148	0.539827837	26
28	2.3E-171	0.617911422	28
30	1.5E-196	0.691462461	30
32	1.7E-223	0.758036348	32
34	3.8E-252	0.815939875	34
36	1.5E-282	0.864333939	36
38	0	0.903199515	38
40	0	0.933192799	40
42	0	0.955434537	42
44	0	0.97128344	44
46	0	0.982135579	46
48	0	0.98927589	48
50	0	0.993790335	50
52	0	0.996533026	52
54	0	0.998134187	54
56	0	0.999032397	56
58	0	0.999516576	58
60	0	0.999767371	60
62	0	0.9998922	62
64	0	0.999951904	64
66	0	0.999979342	66



The Project!

This is an example. In this case we are simulating market share. Any other distribution could be simulated the same way. In this case we got the distribution in the table B11 through C20. This might have been determined empirically or might be management best judgment. From the market size we are then able to calculate units sold. Finally we are simulating a price, and from that we can compute the Revenue. Given some additional information we can compute the FCF and finally the IRR and NPV. In this case we are simulating the IRR. Simulating NPV is not recommended. It would obviously be possible to build a more complex model, but purpose here is demonstrate the simulation process.

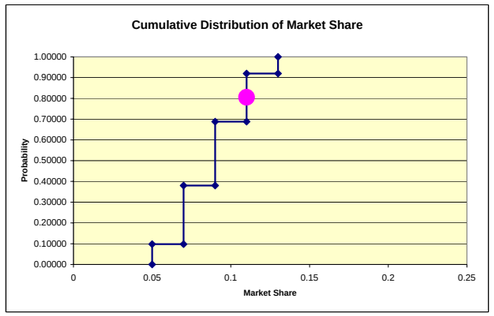
Once you have completed the model go to the Result sheet to simulate.

You can see a result by pushing F9

Rand Number	Market Share
0.805082402	0.11

Table of Outcomes

Cumulative Probability	Market Share
0.00000	0.05
0.09800	0.05
0.09800	0.07
0.38000	0.07
0.38000	0.09
0.68800	0.09
0.68800	0.11
0.92000	0.11
0.92000	0.13
1.00000	0.13



Note that this process works by using the Vlookup function. You can an idea of how it works by looking at help. Just type: =vlookup(in a empty cell and then hit the fx icon on the formula line. The choose help from the resulting box

In general Vlookup looks up a value in a table that is less than or equal to the value. So be sure that your is sorted in ascending order. Any distribution can be lookedup this way. Besure to cover all the possiblities from 0 to 1.0.

Example:

Look Up V 0.37

Result 0.07 **=VLOOKUP(E44,B11:C29,2,TRUE)**

Lookup Value

This the column from which the value is returned (2nd one in this case)

This indicates that it should find the closest match

The Table. It will look in the first colum and return the value in column specificed

A lookup value of .37 returns a market share of .07 (7%). You can try changing the lookup value and see what happen.In the formula in H7 the lookup value is randomly generated.

Units sold = Market share * Market Size

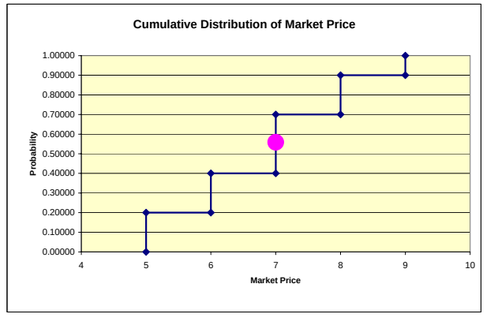
Market Size in U	Units sold	Rand Number	Price
1,000,000	110,000	0.558676105	7

Total Revenue

770,000

Table of Outcomes

Cumulative Probability	Market Price
0.00000	5
0.20000	5
0.20000	6
0.40000	6
0.40000	7
0.70000	7
0.70000	8
0.90000	8
0.90000	9
1.00000	9



This the lookup function for market price

The Lawsuit:

It turns out that the project being sumulated here has a lawsuit pending that if they lose, which the lawyer says has a probablity of .02 all cash flows from period 2 on would be zero.

Rand Number	Probability of losing a law suit.
0.472282621	1

=IF(Q46>=0.98,0,1)

This becomes the multiplier for the FCF for year 2 through 5. If zero the cashflow would all be zero.

Check to see if random is equal to or greanter than .98 and set value to zero if it is

The FCF Model

		Fixed Element	Variable
The project costs		50,000	
Salvage Value		2,500	
WACC			10.00%
Salvage Value percent of cost			5.00%
WC % of Sales			2.00%
Tax rate			34.00%
Cost Factor:		100,000	0.75

	0	1	2	3	4	5
Revenue		770,000	770,000	770,000	770,000	770,000
Cost		677500	677500	677500	677500	677500
Depreciation		9500	9500	9500	9500	9500
EBIT		83,000	83,000	83,000	83,000	83,000
Tax on EBIT		28220	28220	28220	28220	28220
Depreciation		9500	9500	9500	9500	9500
NOPLAT		37720	37720	37720	37720	37720
Delta WC		-15400	0	0	0	0
Cap Exp	-50000	0	0	0	0	2500
FCF	-50000	22320	37720	37720	37720	40220

NPV $80,540.78

IRR 0.56598 **<= Note that cell checks for the existence of an IRR and sets it to -2 if none exists. It also check for losing the lawsuit and computes the IRR under that condition. See Below for an example. This also increases the time it takes to compute each run. But from time to time a single IRR is impossible to get**

WC	0	15400	15400	15400	15400	15400

Here is an example of a run that produced an error (#NUM)

-50000 -6130 2870 2870 2870 5370
<=Cell Content
-30% =IRR(Z33:AE33,AC5)
-0.301853 =IF(ISERROR(IRR(Z33:AE33,AC5))=TRUE,-1,IRR(Z33:AE33,AC5))

This is the cell you select (point to) when you run the simulation (Z23).

Simulation Result for: **The Example Project** Date and Time 2/31/2004 4:42:26 PM

Number of Runs	1000	Address Value	
Average	**0.015741295**	**b1009**	
Max	**1.153980747**		
Minimum	**-2**	**NA Code**	
Variance	**0.690326831**	**-2**	
Std Deviation	**0.830859092**	**See below for NA impact**	
Simulation Sheet Cell Addr:	**Z23 Formula: =IF(T46=0,(+AA20/-(Z20) -1),IF(ISERROR(IRR(Z20:AE20,AC5))=TRUE,-2,I**		
Value	0.335483557		
Simulation Data starts	0.628275326		
	0.189685012		
	-2		
	-2		
	0.335483557		
	-0.155933028		
	0.170318941		
	0.189685012		
	0.628275326		
	0.335483557		
	-0.099174913		
	0.48621791		
	0.565979875		
	0.170318941		
	0.565979875		
	0.170318941		
	0.189685012		
	-0.099174913		
	0.068031707		
	0.565979875		
	0.170318941		
	0.565979875		
	-2		
	-0.099174913		
	-2		
	-0.022833537		
	-2		
	-0.099174913		
	0.068031707		
	0.565979875		
	0.581668592		
	0.335483557		
	-0.099174913		
	0.734725781		
	0.628275326		
	0.335483557		
	0.335483557		

Continues on for 1000 Values

The values from here are updated when you run the simulattion. It only uses the data down to cell address listed above. The rest of the data is iqnored

You should probably not edit the blue text on this sheet. You can delete the graph and black text. It will be replaced when run the simuation. You can also edit the graph if you wish. Be sure to copy and save it, since it will be deleted when you run again.

It took about 10 minutes to run the 5000 simulations on the machine used for testing. A 1000 can be run in about 2 minutes. It does depend upon your machine speed. Your results may well vary. You should be able to estimate the time by watching the progress bar.

This is the frequency distribution of outcomes

			Bin Number	*Bin*	*Frequency*
Range	**3.15**		**0**	**-2**	**128**
Bin Size	**0.16**		**1**	**-1.842300963**	**0**
			2	**-1.684601925**	**0**
			3	**-1.526902888**	**0**
			4	**-1.369203851**	**0**
			5	**-1.211504813**	**0**
			6	**-1.053805776**	**0**
			7	**-0.896106739**	**5**
			8	**-0.738407701**	**4**
			9	**-0.580708664**	**5**
			10	**-0.423009627**	**0**
			11	**-0.265310589**	**1**
			12	**-0.107611552**	**13**
			13	**0.050087486**	**132**
			14	**0.207786523**	**181**
			17	**0.36548556**	**194**
			18	**0.523184598**	**100**
			19	**0.680883635**	**120**
			18	**0.838582672**	**71**
			19	**0.99628171**	**36**
			20	**1.153980747**	**0**
			21	**1.311679784**	**10**
			Count		1000

You can copy this sheet and use it over, you can change its name if you wish. Be sure to give the name of the sheet correctly when requested. You can have mulitple copies in the same workbook as long as they have different names. You also perform additional analysis on the simulated values if you wish.

Adjusted for Missing Values

Average	**0.311629925**
Maximum	**1.153980747**
Minimum	**-1.0086**
Variance	**0.547877811**
Std Deviation	**0.740187686**
Number	**872**
Missing	**128**
Total	**1000**

Date and Time 2/31/2004 4:42:26 PM

The Example Project