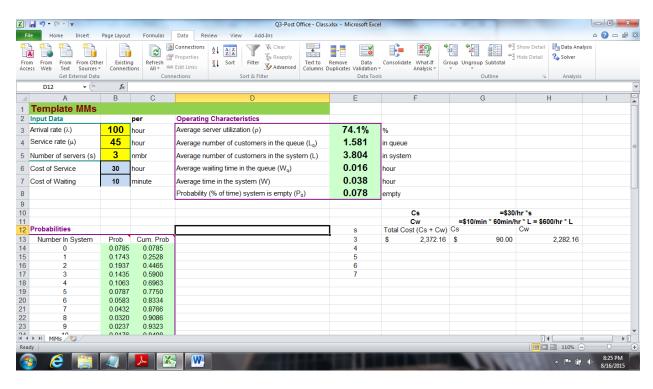## Data Table in Excel Review – Post Office Problem:

The Data Table is a tool in Excel that will automate the completion of a table that is driven by formulas, when the inputs/outputs (to the formulas) will change. For example, in our queuing template if we wanted to build a data table that was dependent upon the number of servers (a yellow cell), then we could automate this process using the Data Table tool in Excel.

Data Table for Post Office Problem:

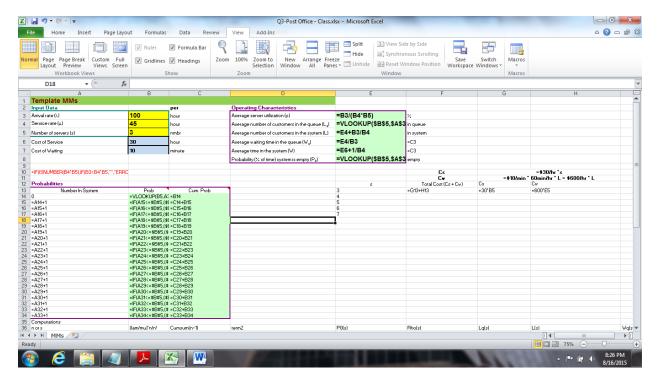
Notice I've setup a table in the lower right of the template.

The formula for Cs is $30/hr * # of servers. The # of servers is cell B5.

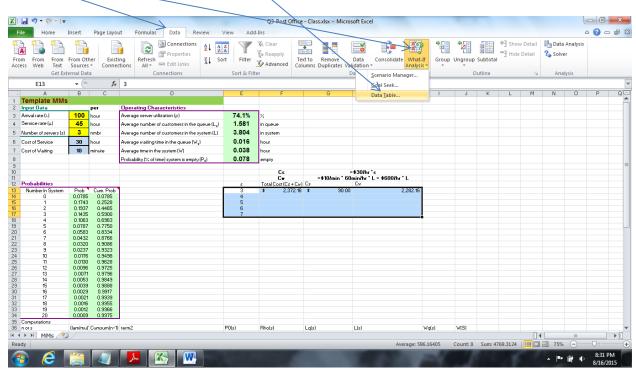The formula for Cw is $600/hr * L. L is cell E5.

Below are the formulas:

(Notice that I have formulas for Cs and Cw and the Total Cost for 3 servers; linked to the yellow and green cells at the top of the template)

The screenshot shows an Excel spreadsheet "Q3-Post Office - Class.xlsx - Microsoft Excel" with the following template content:

	A	B	C	D	E	F	G	H
1	**Template MMs**							
2	**Input Data**		per	**Operating Characteristics**				
3	Arrival rate (λ)	100	hour	Average server utilization (ρ)	=B3/(B4*B5)	%		
4	Service rate (μ)	45	hour	Average number of customers in the queue (Lq)	=VLOOKUP($B$5,$A$3	in queue		
5	Number of servers (s)	3	nmbr	Average number of customers in the system (L)	=E4+B3/B4	in system		
6	Cost of Service	30	hour	Average waiting time in the queue (Wq)	=E4/B3	=C3		
7	Cost of Waiting	10	minute	Average time in the system (W)	=E6+1/B4	=C3		
8				Probability (% of time) system is empty (P0)	=VLOOKUP($B$5,$A$3	empty		
9								
10	=IF(ISNUMBER(B4*B5),IF(B3<B4*B5,"","ERRO					Cs		=$30/hr * s
11						Cw		=$10/min * 60min/hr * L = $600/hr * L
12	**Probabilities**				s	Total Cost (Cs + Cw)	Cs	Cw
13	Number in System	Prob	Cum. Prob		3	=G13+H13	=30*B5	=600*E5
14	0	=VLOOKUP(B5,A:	=B14		4			
15	=A14+1	=IF(A15<=$B$5,($	=C14+B15		5			
16	=A15+1	=IF(A16<=$B$5,($	=C15+B16		6			
17	=A16+1	=IF(A17<=$B$5,($	=C16+B17		7			
18	=A17+1	=IF(A18<=$B$5,($	=C17+B18					
19	=A18+1	=IF(A19<=$B$5,($	=C18+B19					
20	=A19+1	=IF(A20<=$B$5,($	=C19+B20					
21	=A20+1	=IF(A21<=$B$5,($	=C20+B21					
22	=A21+1	=IF(A22<=$B$5,($	=C21+B22					
23	=A22+1	=IF(A23<=$B$5,($	=C22+B23					
24	=A23+1	=IF(A24<=$B$5,($	=C23+B24					
25	=A24+1	=IF(A25<=$B$5,($	=C24+B25					
26	=A25+1	=IF(A26<=$B$5,($	=C25+B26					
27	=A26+1	=IF(A27<=$B$5,($	=C26+B27					
28	=A27+1	=IF(A28<=$B$5,($	=C27+B28					
29	=A28+1	=IF(A29<=$B$5,($	=C28+B29					
30	=A29+1	=IF(A30<=$B$5,($	=C29+B30					
31	=A30+1	=IF(A31<=$B$5,($	=C30+B31					
32	=A31+1	=IF(A32<=$B$5,($	=C31+B32					
33	=A32+1	=IF(A33<=$B$5,($	=C32+B33					
34	=A33+1	=IF(A34<=$B$5,($	=C33+B34					
35	**Computations**							
36	n or s	(lam/mu)^n/n!	Cumsum(n-1)	term2	P0(s)	Rho(s)	Lq(s)	L(s) Wq(s

Now, we could continue building this table one line at a time, but it is faster to do a Data Table in Excel.

Now to create a Data Table for our Total Cost table, we need to highlight the entire table area starting with the 3 server row; and then select "Data Table."
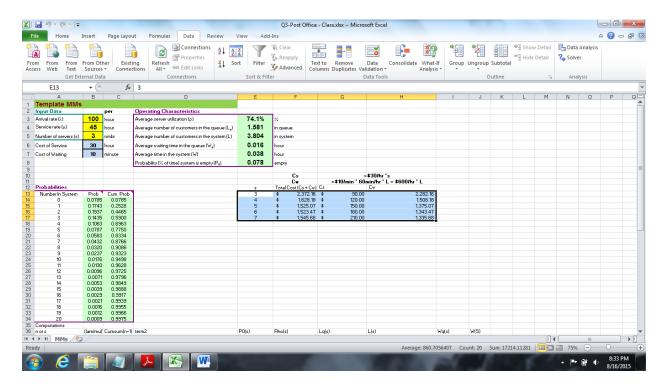
Select "Data" ; "What-If Analysis"; then "Data Table."

For our table, we need to select "Column Input Cell" and change it to B5 which is the number of servers.

(Note, it will label it as $B$5 in the cell once B5 is selected.)

Then click "OK"

[Leave "Row Input Cell" empty.]

And now you have your data table.

Template MMs

Input Data		per	Operating Characteristics		
Arrival rate (λ)	100	hour	Average server utilization (ρ)	74.1%	%
Service rate (μ)	45	hour	Average number of customers in the queue (L_q)	1.581	in queue
Number of servers (s)	3	nmbr	Average number of customers in the system (L)	3.804	in system
Cost of Service	30	hour	Average waiting time in the queue (W_q)	0.016	hour
Cost of Waiting	10	minute	Average time in the system (W)	0.038	hour
			Probability (% of time) system is empty (P_0)	0.078	empty

Cs =$30/hr * s
Cw =$10/min * 60min/hr * L = $600/hr * L

s	Total Cost (Cs + Cw)	Cs	Cw
3	$ 2,372.16	$ 90.00	2,282.16
4	$ 1,628.18	$ 120.00	1,508.18
5	$ 1,525.07	$ 150.00	1,375.07
6	$ 1,523.47	$ 180.00	1,343.47
7	$ 1,545.68	$ 210.00	1,335.68

Probabilities

Number In System	Prob	Cum. Prob
0	0.0785	0.0785
1	0.1743	0.2528
2	0.1937	0.4465
3	0.1435	0.5900
4	0.1063	0.6963
5	0.0787	0.7750
6	0.0583	0.8334
7	0.0432	0.8766
8	0.0320	0.9086
9	0.0237	0.9323
10	0.0176	0.9498
11	0.0130	0.9628
12	0.0096	0.9725
13	0.0071	0.9796
14	0.0053	0.9849
15	0.0039	0.9888
16	0.0029	0.9917
17	0.0021	0.9939
18	0.0016	0.9955
19	0.0012	0.9966
20	0.0009	0.9975

Computations

n or s	(lam/mu)	Cumsum(n-1)	term2	P0(s)	Rho(s)	Lq(s)	L(s)	Wq(s)	W(S)

Note, the above example is for Total Cost of the system. Where Cs is service cost and Cw is the cost of total time in the system. If, we were interested in only time in the queue (or time in line); then we would have used Lq (cell E4) instead of L (cell E5).