Simple Minimization Problem Using QM

In this tutorial, we will solve a simple minimization linear programming problem using Excel QM.

The dean of the Western College of Business must plan the school's course offering for the upcoming fall semester. Student demands make it necessary to offer at least 30 undergraduate and 20 graduate classes in the term. Faculty contracts also dictate that at least 60 courses be offered in total. Each undergraduate class costs the college an average of $2,500 and each graduate class costs $3,000. How many of each should be taught in the fall to minimize total costs?

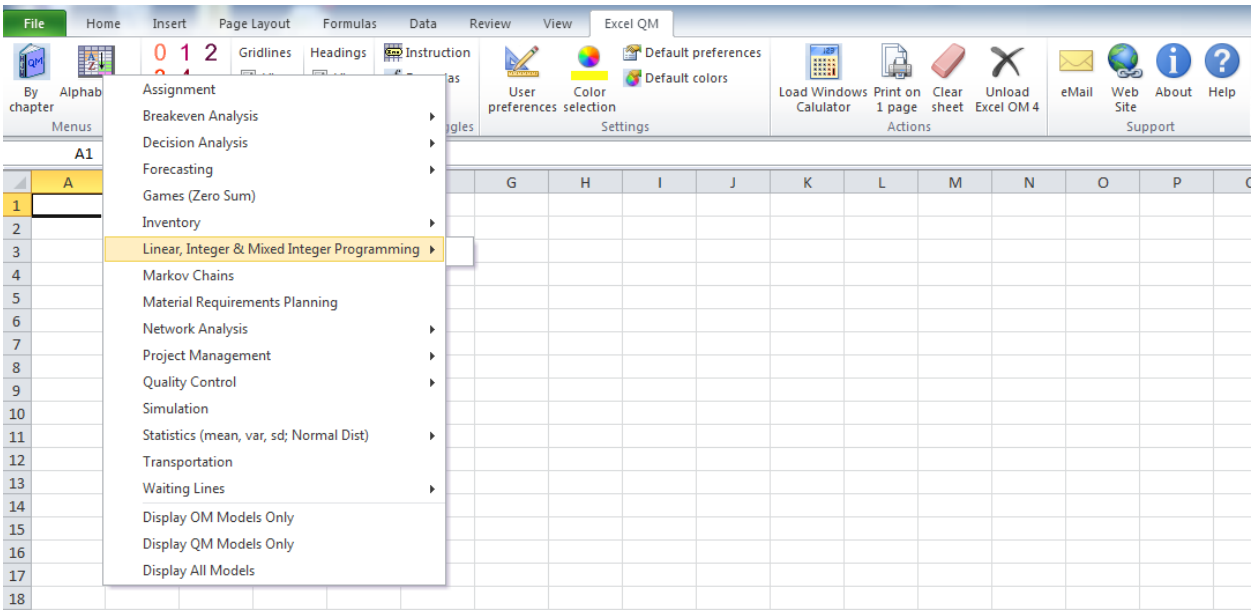
Before we get started on Excel, it is best if we try to first identify the objective functions and the constraints. Clues to identifying the objective function include the words minimize or maximize and in this case, it's *minimizing* total costs.

X_1 = number of undergraduate courses
X_2 = number of graduate courses
Minimize cost = $\$2{,}500X_1 + \$3{,}000X_2$

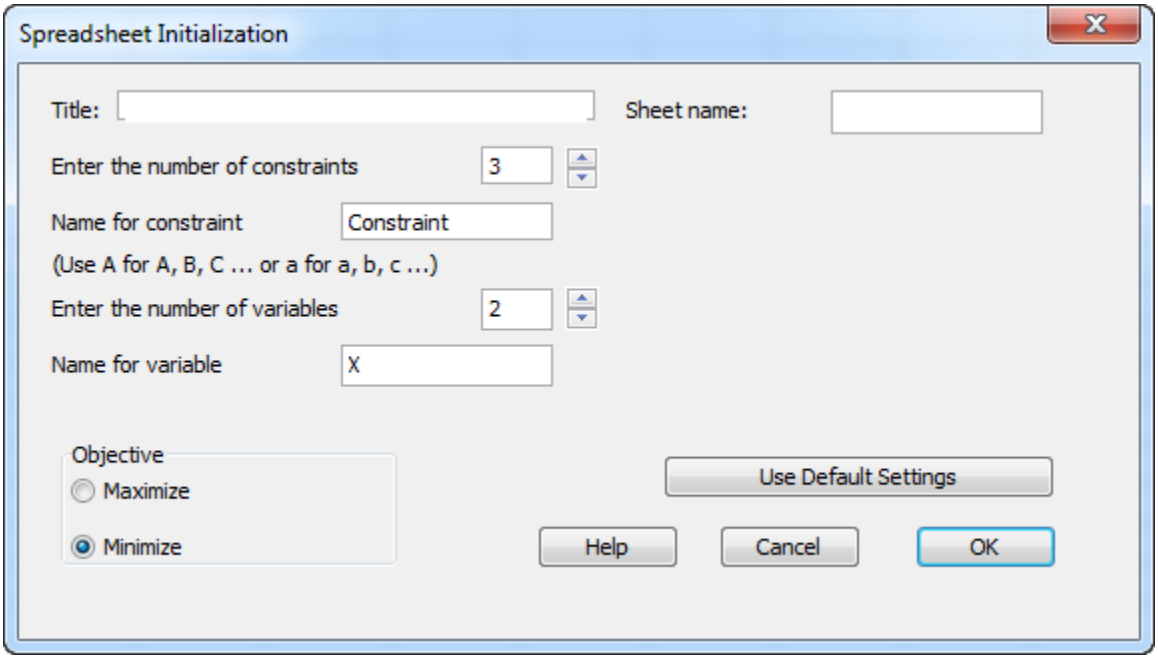
Next, we need to identify our constraints. We have a constraint on the total number of classes taught and the minimum number of undergraduate and graduate classes that need to be included. These can be expressed as:

$X_1 \geq 30$
$X_2 \geq 20$
$X_1 + X_2 \geq 60$

Now, let's open Excel QM and solve our problem. Click on the **Excel QM** tab → **Alphabetical → Linear**, **Integer, & Mixed Integer Programming**.



In the Spreadsheet Initialization window, be sure to identify that we have two variables (X1 and X2) and 3 constraints and that it's a minimization problem.

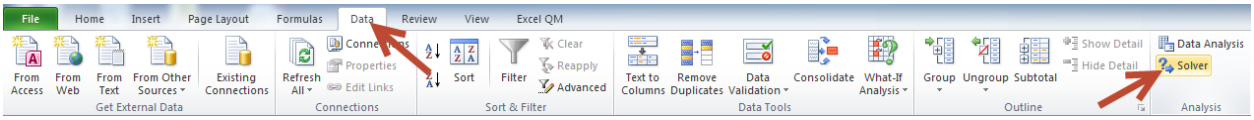


Click **OK**. A spreadsheet will display.

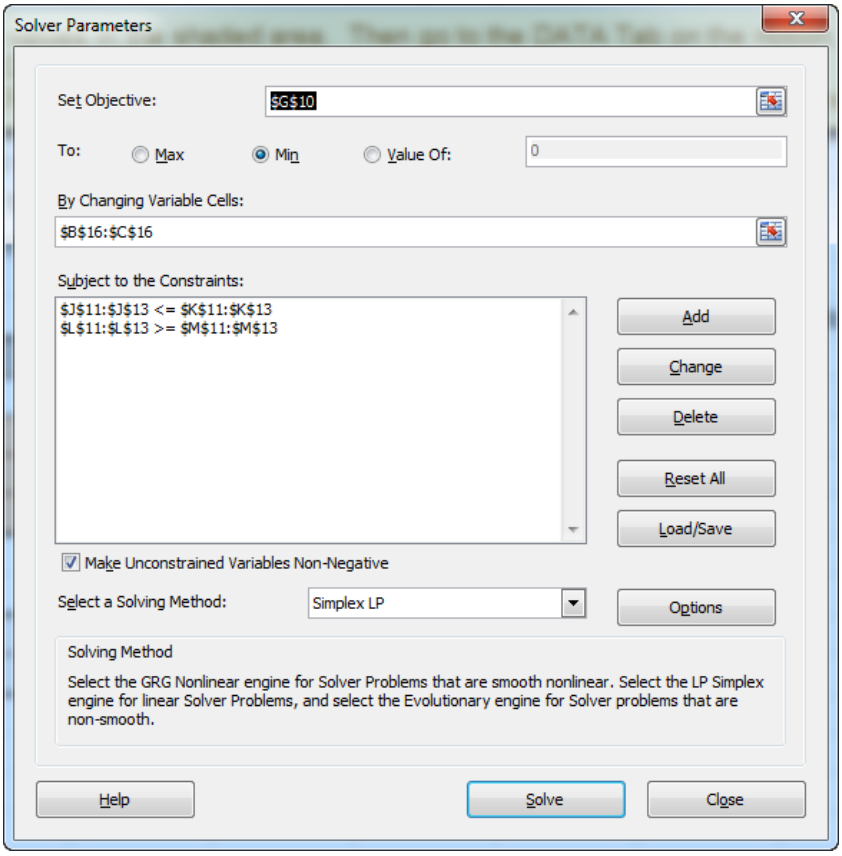
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Linear, Integer and Mixed**	Enter the values in the shaded area. Then go to the DATA Tab on the ribbon, click on Solver in the Data Analysis Group and then click SOLVE. If SOLVER is not on the Data Tab then please see the Help file (Solver) for instructions.											
2													
3	Signs												
4		<	less than or equal to										
5		=	equals (You need to enter an apostrophe first.)										
6		>	greater than or equal to										
7													
8	**Data**						**Results**			Problem setup area			
9		x 1	x 2				LHS	Slack/Surplus					
10	Objective			sign	RHS		0			< constraints		> constraints	
11	Constraint 1			>			0	0		0	0	0	0
12	Constraint 2			>			0	0		0	0	0	0
13	Constraint 3			>			0	0		0	0	0	0
14													
15	**Results**												
16	**Variables**	0	0										
17	**Objective**				0								
18													

In the boxes for our objective function, enter 2,500 under **x1** and 3,000 under **x2**. Our constraints are identified as follows: for **Constraint 1**, enter a 1 under **x1** and 30 under **RHS**; for **Constraint 2**, enter a 1 under **x2**, and 20 under **RHS**; and for **Constraint 3**, enter a 1 under each variable and 60 under **RHS**. Here we are literally telling the computer that our first constraint has one X1 that is greater than 30; our second has 1 X2 that is greater than 20; and our third has one of each and has to be greater than 60. That is it. We have now entered our objective function and all our constraints.

Once you have the data entered correctly, click the **Data** tab and then **Solver**.



A Solver Parameters window will appear.



Click **Solve** and then **OK** in the **Solver Results** window. Our results are shown below.

Data

	x 1	x 2		
Objective	2500	3000	sign	RHS
Constraint 1	1		>	30
Constraint 2		1	>	20
Constraint 3	1	1	>	60

Results

Variables	**40**	**20**		
Objective				**160000**

We can see that it is telling us that we can minimize our costs at $160,000 by offering 40 undergraduate classes and 20 graduate classes. Click here to download the completed spreadsheet table so you can compare it to yours.

This concludes our tutorial on a simple minimization linear programming problem using Excel QM.