Glickman Electronics Example

The Glickman Electronics Company in Washington, DC, produces two products: (1) the Glickman x-pod, a portable music player, and (2) the Glickman BlueBerry, an internet-connected color telephone. The production process for each product is similar in that both require a certain number of hours of electronic work and a certain number of labor-hours in the assembly department. Each x-pod takes 4 hours of electronic work and 2 hours in the assembly shop. Each BlueBerry requires 3 hors in electronics and 1 hour in assembly. During the current production period, 240 hours of electronic time are available, and 100 hours of assembly department time are available. Each x-pod sold yields a profit of $7; each BlueBerry produced may be sold for a $5 profit.

Glickman's problem is to determine the best possible combination of x-pod and BlueBerrys to manufacture to reach the maximum profit.

Solution:

a. Formulate the problem as a linear programming model (that is, define the variables, and write down the objective function and all constraints mathematically).

We begin by summarizing the information needed to formulate and solve this problem. Further, let's introduce some simple notation for use in the objective function and constraints.

Decision Variables

X_1 = number of x-pods to be produced

X_2 = number of BlueBerry to be produced

Objective Function and constraints

$$\text{Max } (\$7X_1 + \$5X_2)$$

Subject to:

$$4X_1 + 3X_2 \leq 240$$
$$2X_1 + 1X_2 \leq 100$$
$$X_1, X_2 \geq 0$$

The objective function created this way represents the overall profit from the operation. Since each x-pod yields a profit of $7, X_1 of them yield $7X_1$ dollars. Similarly, each BlueBerry yields a profit of $5, which means X_2 BlueBerrys yield $5X_2$ dollars. The overall profit will therefore be = $\$7X_1 + \$5X_2$, which is the objective function we are trying to maximize.

As for the constraints, one general relationship is that the amount of a resource used is to be less than or equal to the amount of resource available. Both these constraints represent production capacity restrictions and, of course, affect the total profit.

First constraint:

Electronic time used is ≤ Electronic time available.

Second constraint:

Assembly time used is ≤ Assembly time available.

For example, Glickman Electronics cannot produce 70 x-pods during the production period because if $X_1 = 70$, both constraints will be violated. It also cannot make $X_1 = 50$ x-pods and $X_x = 10$ BlueBerrys.
What is more, since the decision variables represent units of production, we should add a non-negativity constraint for each variable.

b. Create a spreadsheet model for this problem and solve with Excel Solver.

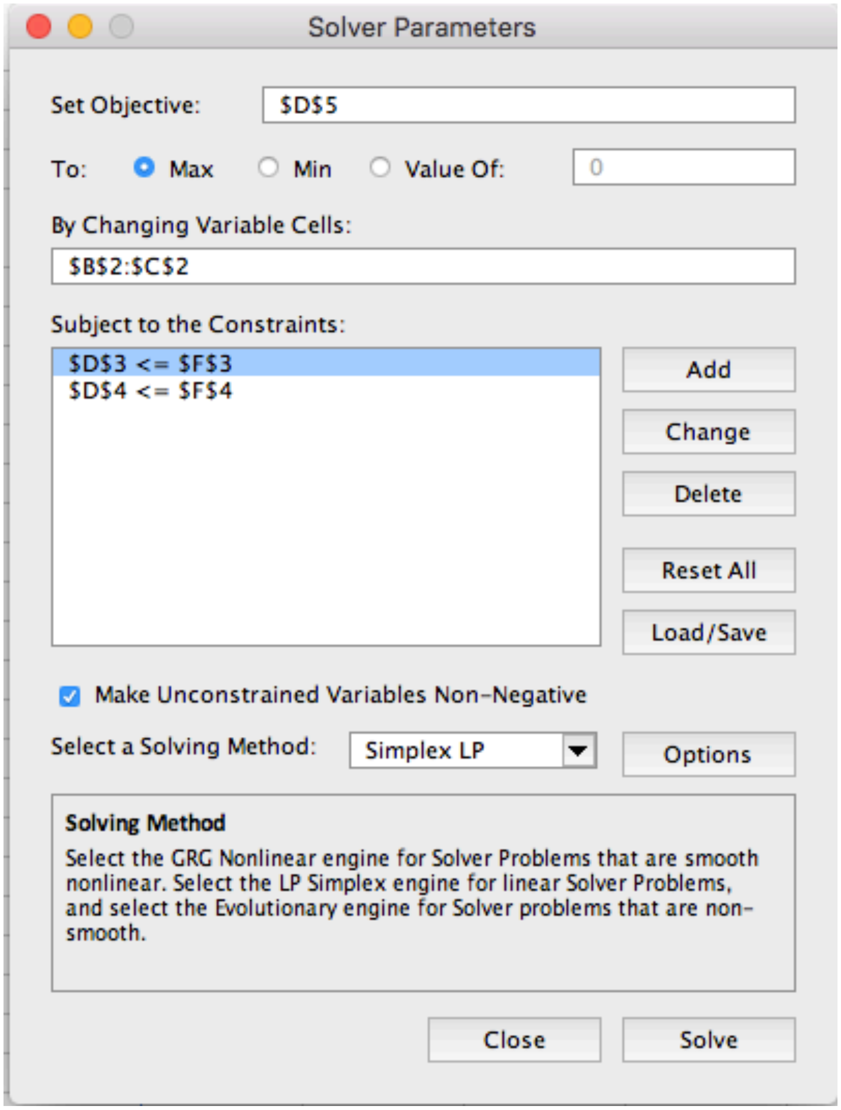

Figure 1 - Solver parameters

	A	B	C	D	E	F
1		**X-PODS (X_1)**	**BLUEBERRYS (X_2)**			
2	**Production**	30	40			
3	**Electronic Constraint**	4	3	240	<=	240
4	**Assembly Constraint**	2	1	100	<=	100
5	**Objective Function (Maximization)**	7	5	**410**		

	A	B	C	D	E	F
1		**X-PODS (X_1)**	**BLUEBERRYS (X_2)**			
2	**Production**	30	40			
3	**Electronic Constraint**	4	3	=SUMPRODUCT(B2:C2,B3:C3)	<=	240
4	**Assembly Constraint**	2	1	=SUMPRODUCT(B2:C2,B4:C4)	<=	100
5	**Objective Function (Maximization)**	7	5	**=SUMPRODUCT(B2:C2,B5:C5)**		

c. What is the optimal solution? What is the optimal value?

The Optimal Solution:
$X_1 = 30$
$X_2 = 40$

The optimal value:
Maximum profit = $410