The demand for two products in each of the last four weeks is shown below.

Week

1 2 3 4

Demand - product 1 23 27 34 40

Demand - product 2 11 13 15 14

Apply [exponential smoothing](http://people.brunel.ac.uk/~mastjjb/jeb/or/forecast.html)with a smoothing constant of 0.7 to generate a forecast for the demand for these products in week 5.

These products are produced using two machines, X and Y. Each unit of product 1 that is produced requires 15 minutes processing on machine X and 25 minutes processing on machine Y. Each unit of product 2 that is produced requires 7 minutes processing on machine X and 45 minutes processing on machine Y. The available time on machine X in week 5 is forecast to be 20 hours and on machine Y in week 5 is forecast to be 15 hours. Each unit of product 1 sold in week 5 gives a contribution to profit of £10 and each unit of product 2 sold in week 5 gives a contribution to profit of £4.

It may not be possible to produce enough to meet your forecast demand for these products in week 5 and each unit of unsatisfied demand for product 1 costs £3, each unit of unsatisfied demand for product 2 costs £1.

* Formulate the problem of deciding how much of each product to make in week 5 as a linear program.
* Solve this linear program graphically.

Solution:

For product 1 applying smoothing constant of 0.7 we get:

M1 = Y1 = 23  
M2 = 0.7Y2 + 0.3M1 = 0.7(27) + 0.3(23) = 25.80  
M3 = 0.7Y3 + 0.3M2 = 0.7(34) + 0.3(25.80) = 31.54  
M4 = 0.7Y4 + 0.3M3 = 0.7(40) + 0.3(31.54) = 37.46

The forecast for week 5 is just the average for week 4 = 37.

For product 2 smoothing constant of 0.7 we get:

M1 = Y1 = 11  
M2 = 0.7Y2 + 0.3M1 = 0.7(13) + 0.3(11) = 12.40  
M3 = 0.7Y3 + 0.3M2 = 0.7(15) + 0.3(12.40) = 14.22  
M4 = 0.7Y4 + 0.3M3 = 0.7(14) + 0.3(14.22) = 14.07

The forecast for week 5 is just the average for week 4 = 14.

For week 5, product 1: 37 and product 2: 14.

Let

x1 = the number of units of product 1

x2 = the number of units of product 2

where x1, x2>=0

The constraints are:

15x1 + 7x2 <= 20(60) machine X

25x1 + 45x2 <= 15(60) machine Y

x1 <= 37 demand for product 1

x2 <= 14 demand for product 2

The objective function is:

Z(max) = 10x1 + 4x2 - 3(37- x1) - 1(14-x2)

Z(max) = 13x1 + 5x2 - 125

The graph is shown below, from the graph we have the optimal solution. The maximum profit is 13(36) + 5(0) - 125 = $343

