ISCTE - IUL
Department of Mathematics

Work Assignment Optimization

Academic Year 2014/2015

A company can produce one of its products by two distinct production processes. In the first production process machines A and C are used. In the second one, machine B is used instead of machine A. This difference has no consequence on the quality of the final product. Minutes per unit required in the production for each process as well as the total number of labor hours of each machine, are presented in the following table.

		Machines		
		A	B	C
Production processes	1	15	-	10
	2	-	12	8
Available labor hours		450	400	500

In the production 3 components are used, and quantities vary depending on the chosen method. The quantity of each component for each method and the total quantities of each component are presented in the next table

		Raw materials		
		RM1	RM2	RM3
Production processes	1	3	-	4
	2	-	2.5	5
Available quantity		5550	3500	13500

Due to contracts previously established with several clients the minimum production per week is 3000 units. The price of each component unit of C1,C2, and C3 used for the product is, respectively, 0.6, 0.6 e 0.5 $m.u.$, and the cost of the use of the machines A, B and C per hour is 10, 18 e 12 $m.u.$ respectively.

1. Formulate the linear programming problem described above. Define the variables and explain the problem constraints of your formulation. (5.0 val.)

2. Using *solver*, compute the optimal solution of this problem. With detail, interpret the generated *output* including the table related with the constraints. (5.0 val.)

3. How much can the cost of one hour of machine A rise without affecting the value (3.0 val.) of the optimal solution?

4. If the minimum production per week changes to 3050 units, what can you say about the cost and the optimal solution of the new problem? Use the results from the previous point. (3.0 val.)

5. Starting from the solution obtained in 2, without solving the new problem and **justifying with detail all your conclusions**, answer to the following questions:

   (a) If, by legal motives, the company couldn't distributed more than 3500 units of its production, what would happen with the optimal solution? (1.0 val.)

   (b) If the available labor hours of the machines B and C had been reduced, at the same time, to 300 and 480 hours, respectively, what would happen to the optimal solution? (1.0 val.)

   (c) What would be the new optimal solution if, due to inflation, the prices rose (1.0 val.) all 10%?

   (d) What would you say for sure about the optimal cost if the company had a third production processe? (1.0 val.)

On internet there exists enough information about the tool *solver* of *excel*. You should do an appropriate research to be able to solve the given problem. For example, you can start **here.**