Date: 10/01/2018 **Época Normal – Block 1** Duration: **1 hour**

**Note**: Justify all your answers and present all the calculations

**Note:** Continuing question **1** from **Block 2** – **The LP problem coincides with the one in block 2, the differences are only on the questions you should answer.**

1. A group of ISEG students offered to help the Mayor of a municipality affected by the fires and droughts that occurred in Portugal with the knowledge acquired in IO. As is well known, the funds are scarce to cope with the various situations caused by these scourges. One of the pressing issues is to provide food for animals. The animals require a minimum daily amount of two types of nutrients that could be provided by pasture or through two forages, **A** and **B**. To identify the funds to be assigned the following LP problem has been formulated:

where, is the quantity (in tones, t.) of forage needed per day, **A**, **B** and the time (in hours) of grazing per day. The objective function minimizes the daily cost of the animals feeding (in monetary units, m.u.).

Solving the LP problem by Solver/Excel the following “Sensitivity Report” was obtained:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable Cells** |  |  |  |  |  |
|  |  |  | **Final** | **Reduced** | **Objective** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Cost** | **Coefficient** | **Increase** | **Decrease** |
|  | $B$6 | forage A t. | 1 | 0 | 3 | 3 | 1 |
|  | $C$6 | forage B t. | 1 | 0 | 4 | 2 | 2 |
|  | $D$6 | Hours of grazing | 3 | 0 | 1 | 1 | 1E+30 |
| **Constraints** |  |  |  |  |  |
|  |  |  | **Final** | **Shadow** | **Constraint** | **Allowable** | **Allowable** |
|  | **Cell** | **Name** | **Value** | **Price** | **R.H. Side** | **Increase** | **Decrease** |
|  | $E$2 | nutrient 1 | 6 | 1,5 | 6 | 2 | 1,333 |
|  | $E$3 | nutrient 2 | 8 | 0,5 | 8 | 4 | 2 |
|  | $E$4 | Max hours of pasture | 3 | -1 | 3 | 2 | 3 |

1. (1,0 point) Write and interpret the optimal solution of the primal, only decision variables.
2. (1,5 points) Write and interpret the optimal solution of the dual (decision variables).

 **(please turn)**

1. Now consider the problem of deciding what quantities to buy from each of the forages, assuming that all pasture availability is used. That is, the problem that results from the previous taking :
2. (2,5 points) Solve the problem by graphical method.
3. (1,0 points) Display an example of:
4. A basic non feasible solution;
5. A non basic feasible solution.
6. (1,0 point) Write the dual.
7. (3,0 points) Perform **one** iteration of the simplex method for the dual problem formulated in **c).**