

(Note: Justify all your answers and present all the calculations. Use methodologies learned in the OR course)

1. A company aims to assign scarce resources to the weekly production of two commodities, C1 and C2, in order to maximize the profit. A tone of C1 yields a profit of 2 m.u., and C2 the double, which means, 4 m.u. per tone. Regarding the use of resources, to produce a tone of C1 2 cubic meters of R1 and 2 of R2 are needed. The production of 1 tone of C2 requires 1 cubic meter of R1 and provides a 1 cubic meter of R2 for free. Moreover, the company should supply a client with a tone of each one of the commodities weekly.

In order to obtain the optimal solution the following LP problem was formulated:

$$\text{Max } Z = 2x_1 + 4x_2$$

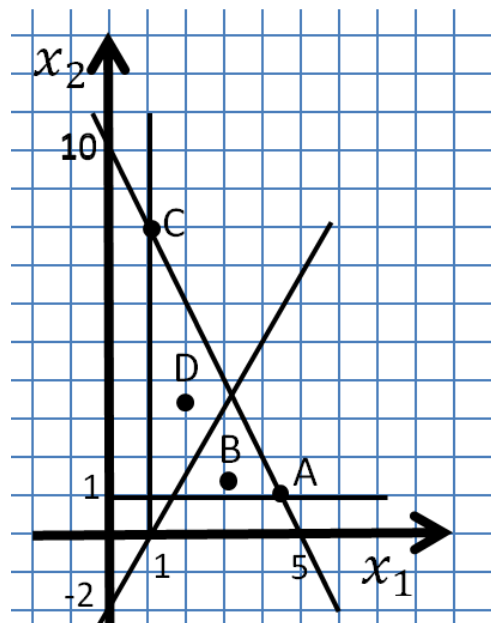
$$\text{s. t. } \begin{cases} 2x_1 + x_2 \leq 10 \\ 2x_1 - x_2 \leq 2 \\ x_1 \geq 1 \\ x_2 \geq 1 \\ x_1, x_2 \geq 0 \end{cases}$$

- a) (0.5 points) Write the meaning of the decision variables  $x_1$  and  $x_2$

$x_1$  \_\_\_\_\_

$x_2$  \_\_\_\_\_

Consider the figure below with an incomplete graphical representation of the given problem:



Name \_\_\_\_\_

No \_\_\_\_\_

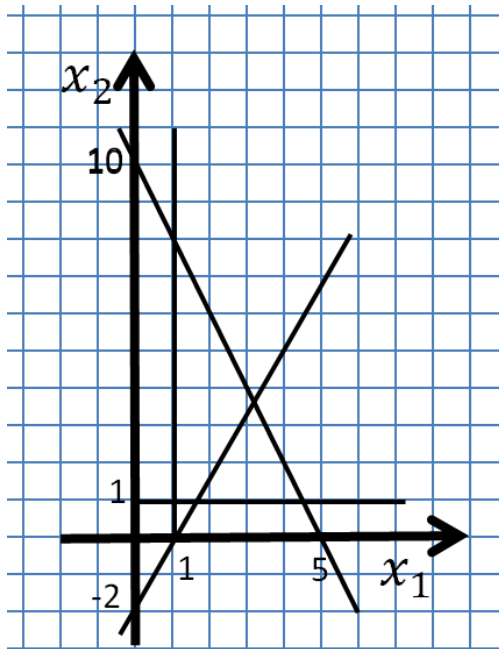
- b) (1.0 point) Identify by shadowing the feasible region of the given problem.
- c) (0.5 points) Represent in the graphic the objective function that corresponds to a profit of 8 m.u.
- d) (1,0 point) Based on the previous answers solve the problem.

e) (1.0 point) Classify the solutions:

- A \_\_\_\_\_;
- B \_\_\_\_\_;
- C \_\_\_\_\_;
- D \_\_\_\_\_.

f) (1.5 points) Write the dual problem.

g) (1.5 valores) Determine by definition, with the help of the graphic, the shadow-price associated with the third constraint. Verify that the value obtained is accordingly the dual formulated in f) and explain the meaning of this shadow-price in the company context.



Name \_\_\_\_\_ No \_\_\_\_\_

2. Consider the following simplex tableaux associated with the resolution of an LP problem.

	z	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	TI
z	1	0	0	0	-4	-1	6
$x_1$	0	1	0	0	0	-1/5	1
$x_3$	0	0	0	1	2	3/5	6
$x_2$	0	0	1	0	2	3/5	4

- a) (2.5 points) Determine a new solution performing one iteration of the simplex algorithm starting with the given tableaux.
- b) (0.5 points) Write and classify the solution found.