INSTITUTO SUPERIOR DE ECONOMIA E GESTÃO

OPERATIONAL RESEARCH

November 11th 2017 **Mid Term Exam** Duration: 1h

Notes: - Justify all answers and display the calculations performed.

- All answers should be given by using methodologies studied in Operational Research.

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1. (4,5) Consider the following LP problem.

$$Max\ Z = 2x_1 + 4x_2$$

s.t.:

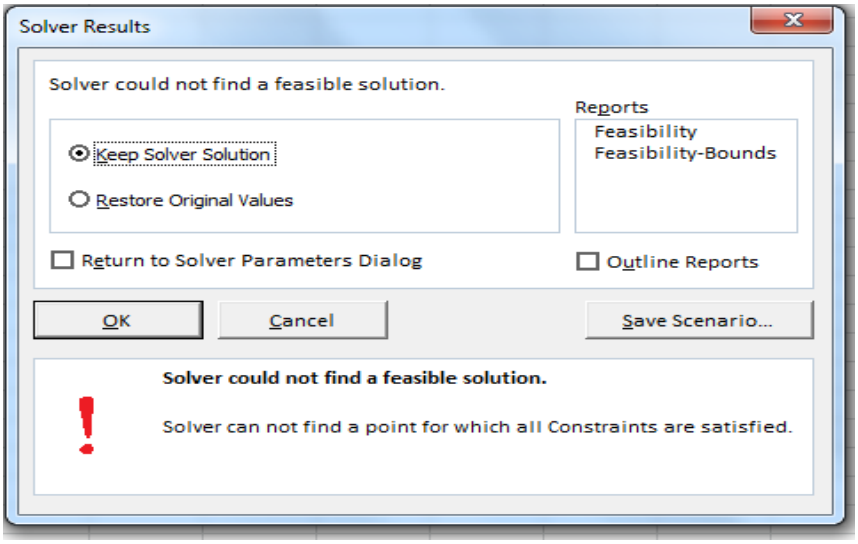
$$\begin{cases} 2x_1 + x_2 \leq 20 \\ x_1 + 2x_2 \leq 18 \\ x_1 - 2x_2 \geq 0 \\ x_1, x_2 \geq 0 \end{cases}$$

a) Perform one iteration of simplex method.

b) Write and classify the solution obtained in a).

c) Write the dual of the given problem.

2. (1,0) Justify in what situation may the following output be obtained while solving an LP problem by Solver/Excel.



3. An investor has 1200 monetary units (m.u.) that can be invested in funds. The information gathered about the three funds available is displayed in the following table:

fund	return rate	aquisition value (in m.u.) of one participation unit
A	9%	1,20
B	8%	1,80
C	6%	1,90

In order to control the portfolio risk the following rules should be observed:

rule 1 – At least 110 participation units of fund C should be acquired

rule 2 – The minimum investment in fund B is 400 m.u.

a) (2,0) Formulate the investor problem by a linear programming model, assuming that any fraction of a participation unit can be acquired, and that the aim is to maximize the total return.

Please turn

An LP formulation of the described problem was solved by Solver/Excel and the reports are on this page. Based on them answer to the following questions.

b) (1,5) Indicate and interpret the optimal solution of the problem (decision and slack variables).

c) (1,0) Indicate and interpret the optimal value of the dual variable associated with the constraint called "budget" in the Solver / Excel output.

Answer Report

Objective Cell (Max)

Cell	Name	Original Value	Final Value
$E$8	OF	0	97,73

Variable Cells

Cell	Name	Original Value	Final Value	Integer
$B$9	Fund A	0	492,5	Contin
$C$9	Fund B	0	222,22	Contin
$D$9	Fund C	0	110	Contin

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
$E$5	rule 1	110	$E$5>=$G$5	Binding	0
$E$6	rule 2	400	$E$6>=$G$6	Binding	0
$E$7	budget	1200	$E$7<=$G$7	Binding	0

Sensitivity Report

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$9	Fund A	492,5	0	0,108	1E+30	0,012
$C$9	Fund B	222,22	0	0,144	0,018	1E+30
$D$9	Fund C	110	0	0,114	0,057	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$E$5	rule 1	110	-0,057	110	311,05	110
$E$6	rule 2	400	-0,01	400	591	400
$E$7	budget	1200	0,09	1200	1E+30	591