Course of Advanced Automation and Control
Exam for the students of the a.y. 2016/2017

January 20, 2017

Surname _____   Name _____

Part I - Optimization & Graphs (Prof. D.M. Raimondo)

1. The company Grecchi s.r.l. uses glaze and ceramics to obtain tiles of two types: A and B. The cost of the basic material is given in the following table

	Cost
Glaze	60 $Euro/Kg$
Ceramics	1.5 $Euro/Kg$

Tiles must fulfill the composition constraint in the table below on the percentage of each material used in the production process

	% of Ceramics	% of Glaze
Type A		between 2% and 5%
Type B		at least 5%

The production of the two type of tiles requires a different amount of human resources: 1 man-hour for each Kg of Type A and 1.5 man hours for each Kg of Type B. Grecchi s.r.l. has a total pool of 4000 man hours. The objective of the company is to maximize profit. For this, the selling price is set to 8 $Euros/Kg$ for tiles of type A and to 12 $Euros/Kg$ for tiles of type B. Note that, if the production exceeds 3000 Kg, then the plant needs an expansion of the production site which comes at the fixed price of 5000 euros.

Please formulate the problem above as a mixed integer linear program in order to support the decision-making process at Grecchi s.r.l (assume that all produced tiles are sold).

2. Please solve the following MILP problem using the branch and bound algorithm

$$\max_{x_1,x_2,\delta_1,\delta_2} \quad 2x_1 + 4\delta_1 - \delta_2$$
$$2x_1 + x_2 + 2\delta_1 \leq 1$$
$$\delta_1, \delta_2 \in \{0,1\}$$
$$x_1, x_2 \geq 0$$

3. Consider the directed network in the figure below. Compute shortest paths from node 2 to all other nodes.