

INSTITUTO SUPERIOR DE AGRONOMIA

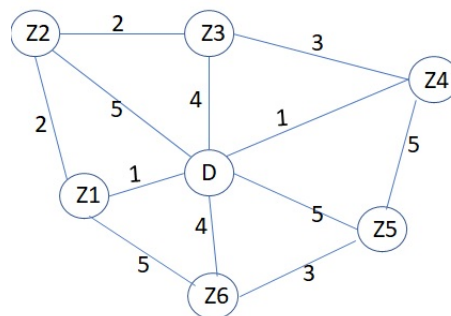
Applied Operations Research - *Integer Programming and Network Models* - 2018/19

Exam 2nd Call

1. (12 val.) A company is considering expansion by building a new factory in either region *A* or region *B*, or perhaps even in both regions. It also is considering building at most one new warehouse, but the choice of location is restricted to a region where a new factory is being built (if the factory is not built, the warehouse is not either). The profit of each of these alternatives is shown in the second column of the table below. The third column gives the capital required (already included in the profit) for the respective investments, where the total capital available is 10 million euros. The objective is to find where to build the factory or the factories, and the warehouse (if the decision is to build one), in order to maximize the profit.
- Formulate the problem in integer programming, explaining the meaning of the decision variables.
 - Find all feasible solutions of the problem and select an optimal solution.

	Profit (10 ⁶ €)	Capital request (10 ⁶ €)
Built factory in <i>A</i>	9	6
Built factory in <i>B</i>	5	3
Built warehouse in <i>A</i>	6	4
Built warehouse in <i>B</i>	4	1

2. (8 val.) One wants to build a minimum distance network of pipes for water distribution between a reservoir *D* and 6 zones *Z1*, ..., *Z6*. The network below shows possible links between the reservoir and each zone and between some pairs of zones. Near each edge is displayed the corresponding distance.



Use a minimum spanning tree algorithm to solve the problem. Explain each step of the method you applied.