

**Exercise 1** Consider the following problem description: “After winning the lottery, you decide to buy several trucks. Your goal is to deliver goods to all supermarkets in Coimbra. But now you have to build warehouses to store the goods, and you have to think about possible locations. Ideally, the warehouses should be located close to the supermarkets in order to reduce transportation costs. However, you cannot spend all the money on building warehouses everywhere, so you have to make a clever decision: given the fixed cost of building each warehouse in each possible location and the transportation cost of serving each supermarket from each location, you want to know where warehouses should be build so that the overall cost (transportation and fixed costs) over that period is minimum. Note that at least one warehouse must be built. Moreover, the computation of the overall transportation cost has to take into account that all supermarkets must be served.”

- a) Define the set of feasible solutions, how the solution value can be computed, and how the branching, in a possible branch-and-bound approach, can be performed.
- b) Derive a bounding function that provides a lower bound on the optimal value for this problem. Consider the following example for illustration purpose:

	fixed cost	transportation cost to supermarket				
		1	2	3	4	5
warehouse 1	10	8	6	10	8	10
warehouse 2	9	1	2	10	4	8
warehouse 3	10	6	4	2	1	5
warehouse 4	1	10	4	6	9	3

- c) Derive a procedure that computes an upper bound on the optimal value for this problem.

**Exercise 2** Read the problem *(Un)Social Network* in EA2022.PL in Mooshak and solve it using the techniques discussed above.