Network Design [Network Optimization Module]
Exam June, 18th 2019

Surname   _____

Name   _____

Exercise #1

The graph **graph18062019.gml** in the attached file contains a set of potential locations that a telecom company can connect with a network rooted in node 1. Each location (node) u has associated a profit [**profit** attribute in the graph], a number of customers [**customer** attribute in the graph] and each edge uv has a connection cost [**cost** attribute in the graph].

1. Design a network that maximizes the company profit
2. The company will receive an incentive of 1250 Euro if it connects at least 87% of the customers. Is it convenient to achieve this coverage target?
3. Design a network that maximizes the company profit with the constraint that the maximum number of hops from the root node cannot exceed 4.
4. In case 3), the company can install in the root a router device (cost 1450 Euro) that halves the connection costs to any node connected to the root but can accept up to 8 connections. Is it convenient to install such a device?

Exercise #2

The graph **atsp18062019.gml** represents a logistic distribution network. Each arc has a cost [**dist** attribute in the graph]. The company must deliver one unit of good to each node of the graph. Calculate the costs of the following delivering strategies:

1. The company stores all goods in node 1 and uses a vehicle with C = 50.
2. The company uses a vehicle with C = 50 but goods are not stored in node 1. Precisely, the company may locate a warehouse in one of the following nodes: {2,15,20}.
3. The company decides to store goods in all three locations and to use 3 vehicles that travel up to 10 nodes each.

If one of the problems above can be formulated as an ATSP, then use the lifted MTZ formulation plus the size 2 subtour inequalities. For this model, report the value of the linear relaxation and the number of enumerated nodes. Then, strengthen the formulation by adding violated Subtour Elimination Constraints and calculate the improved linear relaxation and the number of enumerated nodes of the strengthened model.

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