HOMEWORK-1

1. A multinational company has production plants in several countries and considers to open two new plants to reduce transportation costs. The set of open plants is denoted by $\bar{F}$ and the set of candidate locations for the new facilities is donated by F. The production capacity of a facility $f \in F \cup \bar{F}$ is given by q_f. Let K denote the set of customers. The demand amount of a customer $k \in K$ is given as d_k and the company has to serve all customers' demands. Per unit transportation cost per unit distance is given as c and the distance between a facility $f \in F \cup \bar{F}$ and a customer $k \in K$ is denoted by t_{fk}. Due to the customs regulations not every facility can serve every customer. The set of customers a facility $f \in F \cup \bar{F}$ can serve is given $K(f)$. Formulate a **mixed integer linear program (MILP)** to find the locations of the two new facilities that would minimize the total transportation costs.

2. A new cargo company wants to build a delivery network in Turkey, using a hub-and-spoke structure. The data about the expected demand, transportation cost, transportation time, and setup costs for the candidate hub locations are presented in the attached data file (TurkishData.xlsx).

   (a) Assume that the company wants to open only a single hub. Use the single-hub location algorithm we discussed in class to find the optimal location that minimizes the total setup and transportation costs. Upload your code and the final screenshot that shows the result.

   (b) Now assume that the company has a total budget of 2400 to spend for the hub facilities. Write down a MILP model to find the optimal hub locations that minimize the **total transportation cost** and solve your model on your favorite mathematical modeling environment. Upload your code and the final screenshot that shows the result.