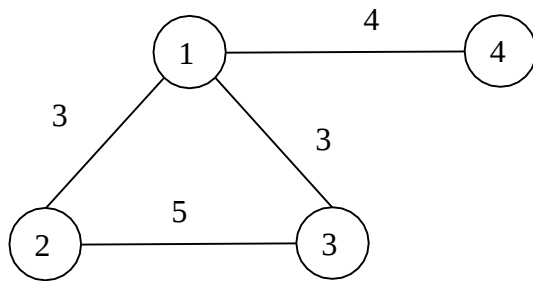


IE 479: HW2

Question 1: Solve the covering problem with 6 possible locations with $f=(5,6,4,4,2,3)$ and 5 customers with $p_j=3$. A location covers a customer if it is within 55 km distance.

Distance (km)		Customer				
		1	2	3	4	5
Location	1	65	55	40	80	30
	2	70	70	55	80	20
	3	80	30	60	75	80
	4	30	40	80	40	70
	5	60	75	80	10	25
	6	20	60	75	30	80

Question 2: Consider the following network. Suppose all 4 nodes are customers.



We want to open a DC so as to minimize the longest distance to any customer.

- Find the best location for the DC when the DC will be located at one of the 4 nodes.
- Suppose the DC can be located along the edges also. Find the best location by two different algorithms discussed in class. Show all your work.

Question 3: Mayor of Ankara is planning to establish a 24-hour ambulance service. There are 2 different types of ambulances. Blue-type (which contains basic life support) and Red-type (which contains paramedics). Ambulance base stations are also need to be established to host the ambulances. Let $M = \{1, \dots, m\}$ denote set of available sites for ambulance base stations and let f denote the fixed cost of locating a base at any of the sites $\in M$. Let C^R : cost of buying a red-type ambulance and C^B : cost of buying a blue-type ambulance. Assume all costs are annualized. The main decisions are where to open the bases and what type(s) of ambulances to have at the bases.

The population of Ankara is aggregated into districts $N = \{1, \dots, n\}$. Let P_i : denote the number of people living in district i . A district is receiving Red-Type ambulance service if it is within 5 minutes drive from a Red-Type ambulance location and similarly Blue-Type ambulance service if it is within 9 minutes drive from a Blue-Type ambulance location. Let t_{ij} denote the travel time from $j \in M$ to $i \in N$.

- Suppose a district will be considered as receiving service if it receives both type of ambulance services. The budget for the next year is going to be prepared and the Mayor wants to know the least costly way of providing both type of services of every district. Formulate a model for this case.

- b) Formulate a linear model in which the government has a total budget of C \$ and wants to maximize the number of people receiving service.
- c) Suppose now basic coverage is a must and each district needs to get a blue-type ambulance service. And we want to maximize the number of people receiving red-type ambulance service. Assume that the government has a total budget of C \$.
- d) Suppose now a district will receive service as long as it is reached by either a red or a blue-type ambulance. Let q : denote a level of appreciation / people if served by a blue-type ambulance and $3q$ denote the appreciation level / people for service with a red – type ambulance. Formulate so that the total appreciation will be maximized. The government also at least Q people receiving service. (Be careful in double counting) Assume that the government has a total budget of C \$.
- e) Say there is one hospital located in Ankara, located at k. For each district i in N, Let d_{ik} denote the travel time from district i to hospital. Suppose now there is an additional requirement on the total journey time of the Red and Blue Type ambulances. The journey is defined from the base till the hospital (base-served district-hospital). Say Red-Type ambulances should finish their journey within 12 minutes and Blue Type ambulances should finish the journey within 14 minutes. Assume that it takes 2 minutes to take the patient at the district stop. Suppose also that each district should receive basic life support. Formulate a model which will additionally maximize the number of people receiving Red-Type ambulance. Say we need to establish p base stations in total