

Q 1: GreenAir is a new airline company which wants to start operations in a country. The existing airline of that country, BlackJet goes to the routes as defined in the table below. For example BlackJet goes from City A to B and B to A, as all routes are bidirectional.

GreenAir wants to keep their running cost to a minimum in the starting year and cannot offer all the routes as BlackJet provides. They need to select some routes. They ask you which routes to select such that their fuel expenses are minimum. Remember that fuel expense is directly proportional to distance travelled by aircraft.

- Which routes they should choose such that the distance travelled by their aircrafts is minimum and all cities are still reachable from each other.
- After 1 year of operation they are in a good position to expand. Petrol prices also went down last year so they are no more concerned about minimizing distance. Now they want to select routes which maximize their profit, as each route has a different ticket price. Which routes should they choose to maximize profit? (They would be interested in choosing route which have high ticket cost. Also they still want that all cities are reachable from all other cities (no city where GreenAir does not provide service))

For both a) and b) you may show your routes by a table or graph and tell how you came up to the solution. Which algorithm you use? Tell if the routes for a) and b) are same or different.

City	City	Distance (km)	Ticket price (PKR)
A	B	400	5k
A	C	500	10k
B	D	100	3K
B	C	200	3K
D	E	700	8K
C	E	300	2K

Q 2: Consider a maze represented as a two dimensional array of numbers, as shown below. The maze can be traversed following any orthogonal direction (i.e., north, south, east and west). Considering that each cell represents a cost, how will you find the minimum cost to travel the maze from the top-left corner to the bottom-right corner of a given maze of size $N \times M$

Example matrix

0	3	1	2	9
7	3	4	9	9
1	7	5	5	3
2	3	4	2	5

- a) How will you solve this problem? Explain in 3 lines in plain English.
- b) To find a solution, which known algorithm will you use?
- c) Run your algorithm on the above matrix and show how it finds out the minimum cost
 Show your working for each step, in each step you need to choose where to go. Show it like:
 Step 1: A[0,0] start from top left
 Step 2: A[x,y]
 .
 .
 Step Z: A[3,4] which the bottom right corner
- d) What is the minimum cost in the above matrix (by running the steps you showed in part c)?