COMSATS University Islamabad, Abbottabad Campus
Department of Mathematics
Terminal Exam Fall 2025

Class: BSE-7A
Date: December 23, 2025
Subject: Operations Research (MTH-467)
Instructor: Muhammad Zubair
Total Marks: 100
Time Allowed: 180 minutes
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Reg No: FA22-BSE-088

CLO-I

1. Use North West Corner method to find the initial basic solution of the transportation problem. Then apply MODI or Stepping Stone method to obtain optimal solution of transportation problem using the data below. (16 marks)

Source	1	2	3	4	Supply
1	8	6	10	9	20
2	9	7	4	2	30
3	3	4	2	5	25
4	6	8	7	6	15
Demand	15	25	20	30	90

2. A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix. How should the jobs be allocated, one per employee, so as to minimize the total man hours?

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(Hint: Hungarian Method) (10 marks)

	I	II	III	IV	V
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

CLO-II

3. Consider the following figure that gives the mileage of the feasible links connecting nine offshore natural gas wellheads with an inshore delivery point. Because wellhead 1 is the closest to shore, it is equipped with sufficient pumping and storage capacity to pump the output of the remaining eight wells to the delivery point. Determine the minimum pipeline network that links the wellheads to the delivery point. (Hint: Kruskal's and Prim's) (16 marks)

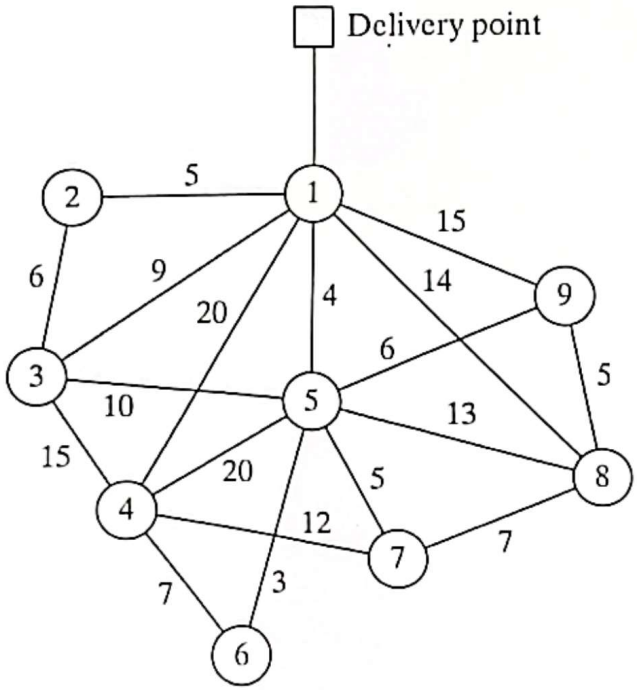


Figure 1: Kruskal's and Prim's Algorithm

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4. Use Dijkstra's algorithm to find the shortest route between node 1 and every other node of the given figure: (10 marks)

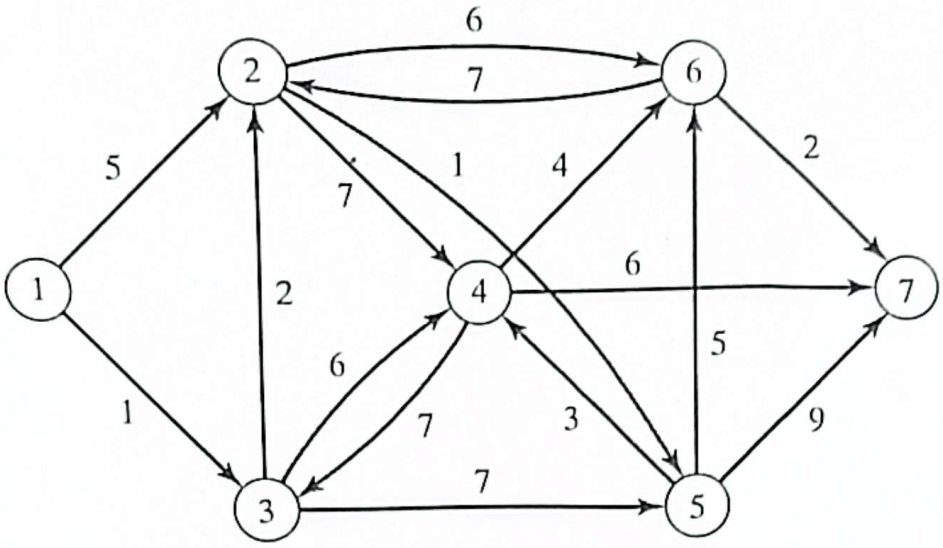


Figure 2: Dijkstra's Algorithm

CLO-III

5. A salesman travels from one place to another; he cannot, however, travel from one place and back. The distances (in km) between pairs of cities are given below: (16 marks)

	1	2	3	4
1	∞	15	25	20
2	22	∞	45	55
3	40	30	∞	25
4	20	26	38	∞

The problem is to chalk out a route which enables him to visit each of the cities only once, so that the total distance covered by him is minimum.

6. The following table gives the activities for buying a new car. Construct the project network. Determine the critical path for the project. Also determine the total and free floats for non-critical activities.

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TF_{ij} (Total Floats) $= LC_j - ES_i - D_{ij}$

and FF_{ij} (Free Floats) $= ES_j - ES_i - D_{ij}$. (16 marks)

Activity	Description	Predecessor(s)	Duration (days)
A	Conduct feasibility study	–	3
B	Find potential buyer for present car	A	14
C	List possible models	A	1
D	Research all possible models	C	3
E	Conduct interview with mechanic	C	1
F	Collect dealer propaganda	C	2
G	Compile pertinent data	D, E, F	1
H	Choose top three models	G	1
I	Test-drive all three choices	H	3
J	Gather warranty and financing data	H	2
K	Choose one car	I, J	2
L	Choose dealer	K	2
M	Search for desired color and options	L	4
N	Test-drive chosen model once again	L	1
O	Purchase new car	B, M, N	3

7. Consider the following graph. (16 marks)

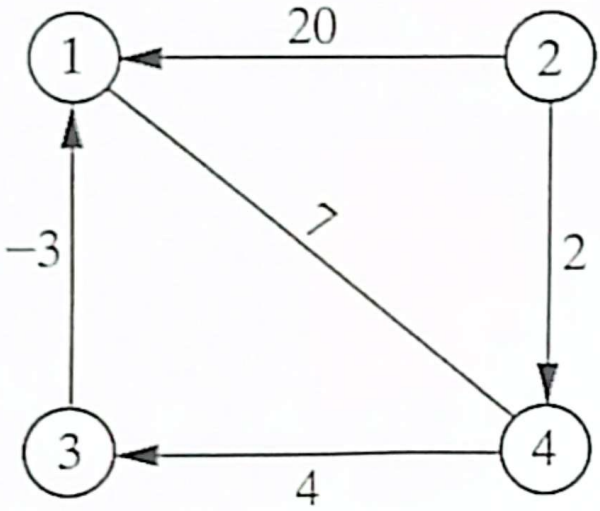


Figure 3: Floyd's Algorithm

Apply Floyd–Warshall Algorithm to compute the lengths of shortest paths between all pairs of nodes.

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