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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
END SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCINENCE IN
(MATHEMATICS)
KMA 402 –OPERATIONS RESEARCH II
SPECIAL

Date: 17TH AUGUST 2023
 Time: 8:30AM –
 10:30AM

INSTRUCTIONS TO CANDIDATES

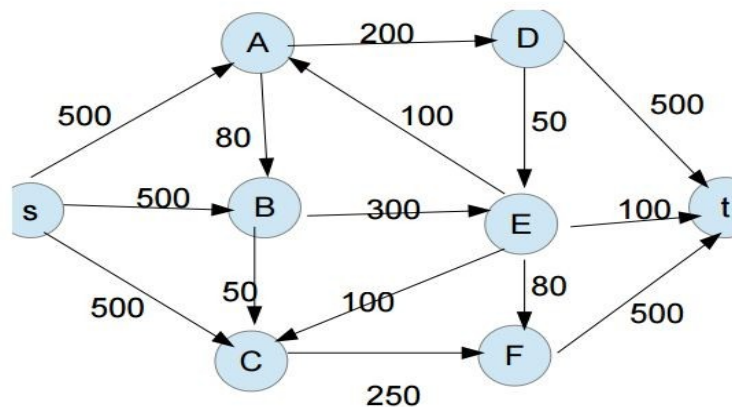
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

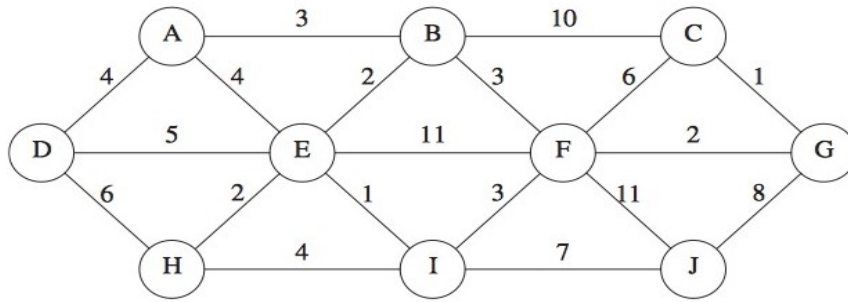
- a) Define the following terms: (4 Marks)
- i. Network
 - ii. Tree
- b) Discuss the characteristics of two players zero sum game. (5 Marks)
- c) Solve the game with the pay-off matrix for player A as given in table. (3 Marks)

		Player B		
		B ₁	B ₂	B ₃
Player A	A ₁	-4	0	4
	A ₂	1	4	2
	A ₃	-1	5	-3

- d) Find the maximum flow from source s to sink t in the network below. (6 Marks)



- e) Find a minimum spanning tree for the network below. (6 Marks)



- f) A company has five machines that are used for four jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table. Find the assignment schedule that minimizes the total cost of executing all the jobs. (6 Marks)

		Machines				
		A	B	C	D	E
Job	1	5	7	11	6	7
	2	8	5	5	6	5
	3	6	7	10	7	3
	4	10	4	8	2	4

QUESTION TWO (20 MARKS)

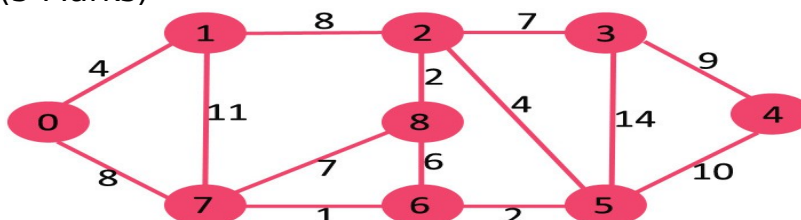
- a) Discuss the key difference between CPM and PERT techniques. (8 Marks)
- b) A project consists of 13 activities for which the relevant information is given as follows:

Activity	Preceding activity	Duration (weeks)
P	-	3
Q	-	4
R	P	5
S	Q	5
T	R,S	7
U	R,S	5
V	T	2
W	U	10

- Draw the network for the project. (3 Marks)
- Identify the critical path and determine the project duration. (4 Marks)
- Calculate total float, free float and independent float for each activity. (5 Marks)

QUESTION THREE (20 MARKS)

- a) Find the shortest route from node 1 to node 4. (5 Marks)



- b) The following table contains the three time estimates for a PERT network. (Duration in days).

Activity	a	m	b
1, 2	2	3	4
1, 3	4	6	8
1, 4	4	5.5	10
2, 3	1	3	5
2, 5	3	7.5	9
3, 4	6	7.5	12
3, 6	3.5	5	6.5
4, 6	2	2.5	6
5, 6	0.5	2	3.5

- i. Identify the critical path and expected completion time of the project. (6 Marks)
- ii. What are the chances of reaching event 4 by day 13? (4 Marks)
- iii. The contract schedule allows 18 days in which to complete the entire project. What are the chances that the Project WILL NOT be finished on time? (5 Marks)

QUESTION FOUR (20 MARKS)

- a) Discuss the key decision making environments. (4 Marks)
- b) A hiker must pack three items: food, first-aid kit and clothes. The backpack has a capacity of $3ft^3$. Each unit of food takes $1ft^3$, a first-aid kit occupies $\frac{1}{4}ft^3$ and each piece of cloth takes about $\frac{1}{2}ft^3$. The hiker assigns the priority weights 3, 4 and 5 to food, first-aid kit and clothes. From experience, the hiker must take at least one unit of each item and no more than two first-aid kits. How many of each item should the hiker take? (10 Marks)
- c) A marketing manager has five salesmen and sales districts. Considering the capabilities of the salesmen and the nature of districts, the marketing manager estimates that sales per month (in hundred rupees) for each salesman in each district would be as follows. Find the assignment of salesmen to districts that will result in maximum sales. (6 Marks)

		District				
		A	B	C	D	E
Salesman	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

QUESTION FIVE (20 MARKS)

- a) Is the following two-person zero-sum game stable? Solve the game given below in table.

(6

Marks)

		Player B			
		1	2	3	4
Player A	1	5	-10	9	0
	2	6	7	8	1
	3	8	7	15	1
	4	3	4	-1	4

- b) RVW (Restored Volkswagens) buys 15 used VW's at each of two car auctions each week held at different locations. It then transports the cars to repair shops it contracts with. When they are restored to RVW's specifications, RVW sells 10 each to three different used car lots. There are various costs associated with the average purchase and transportation prices from each auction to each repair shop. Also there are transportation costs from the repair shops to the used car lots. RVW is concerned with minimizing its total cost given the costs in the table below.

- i) Given the costs below, draw a network representation for this problem.

(4 Marks)

	Repair Shops			Used Car Lots		
	S1	S2		L1	L2	L3
Auction 1	550	500	S1	250	300	500
Auction 2	600	450	S2	350	650	450

- ii) Formulate this problem as a trans-shipment linear programming model and find a schedule that minimizes the total cost.

(10 Marks)