LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **COMPUTER SCIENCE**

FIFTH SEMESTER – **APRIL 2023**

CS 5402 – OPERATIONS RESEARCH

Date: 11-05-2023 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION-A

ANSWER ALL THE QUESTIONS: **(10X2=20)**

1. Define Operation Research.
2. State the limitations of Graphical method.
3. When is transportation problem said to be unbalanced? Give an example.
4. State job sequencing problem.
5. Write down the route condition for the traveling salesman problem.
6. What is idle time?
7. What does PERT stand for? What is the objective of PERT?
8. Define dummy Activity
9. Define Inventory.
10. What is setup cost?

SECTION-B

ANSWER ALL THE QUESTIONS: **(5X8=40)**

11. a) A company manufacturers two products A and B in two departments namely assembly department and painting department. It takes two hours in the assembling department and one hour in painting department to manufacture one unit of product A. It takes two hours in the assembling department and 2 hours in painting department for manufacturing one unit of product B. The assembling department works for three 8 hours shift per day and painting department works two 8 hours shift per day. The profit of the product A is Rs.100 and the profit of the product B is Rs.150 per unit. How many units of product A and B to be manufactured so as to maximize the profit for the company?

(OR)

b) Solve the following LPP by Graphical method:

Max $Z = 3x_1 + 4x_2$ subject to the constraints:

$2x_1 + x_2 \leq 40$

$2x_1 + 5x_2 \leq 180$

$x_1, x_2 \geq 0$

12. a) Obtain an initial basic feasible solution to the following transportation Problem using the north-west corner rule.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirements	200	225	275	250	

(OR)

b) Solve the following Traveling salesman problem.

	A	B	C	D
A	-	46	16	40

B	41	-	50	40
C	82	32	-	60
D	40	40	36	-

13. a) A marketing manager has 5 salesmen and 5 sales districts. Considering the capabilities of the salesman 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:

Salesman	Sales District				
	A	B	C	D	E
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

What is the maximum sales that may be expected if an optimum assignment is made?

(OR)

b) Find the sequence that minimizes the total elapsed time (in Hrs) required to complete the following task on 2 machines. Also find the total elapsed time and idle time of each machine.

Jobs	**J1**	**J2**	**J3**	**J4**	**J5**	**J6**	**J7**
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

14. a) A is the operation on the project. B&C can be done concurrently & both must follow A**.** B must proceed D**.** E can not begin until both B&C are completed. F is dependent on the completion of both D&E. F is the last operation on the project. Draw the arrow network and number the nodes according to Fulkerson's Rule.

(OR)

b) i) Write down the difference between PERT & CPM. **(4)**

(ii) Define the following terms:

a) dummy activity b) critical path **(4)**

15. a) Explain the various cost associated with Inventory.

(OR)

b) Find the optimum order quantity for a product for which the price breaks are as follows:

Quantity	Purchasing cost per unit
$0 \leq Q1 < 100$	20
$100 \leq Q2 < 200$	18
$200 \leq Q3$	16

The monthly demand for the product is 400 units. The storage cost is 20% of the unit cost of the product and the cost of ordering is Rs.25 per month.

SECTION-C

ANSWER ANY TWO QUESTIONS: **(2X20=40)**

16. i) Solve by Simplex method : **(10)**

Max $Z = 2x_1 + 5x_2$ Subject to the constraints:

$$x_1 + 4x_2 \leq 24$$
$$3x_1 + x_2 \leq 21$$
$$x_1 + x_2 \leq 9$$
$$x_1, x_2 \geq 0$$

ii) A firm has 3 factories producing certain product and it is to be transported to five distribution centers. The unit transportation costs (in 100's of Rupees) from factories to the distribution centers are given below.

Distribution Centers						
		D1	D2	D3	D4	D5
Factories	F1	3	2	3	4	1
	F2	4	1	2	4	2
	F3	1	0	5	3	2

Total productions of F1,F2 & F3 are 100,125,75 and the demands of distribution centers D1,D2,D3,D4 & D5 are 100,60,40,75,25 units respectively. Determine the transportation pattern to **optimally** minimize the overall shipping cost. (Using VAM) **(10)**

17. i) Find the sequence that minimizes the total elapsed time (in Hrs) required to complete the following task on 2 machines. Also calculate total elapsed time and idle time of each machine**. (10)**

Tasks	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**`I**
Machine 1	2	5	4	9	6	8	7	5	4
Machine 2	6	8	7	4	3	9	3	8	11

ii) Given the following information:

Activity	1-2	1-3	2-3	2-4	2-5	3-4	4-7	5-6	5-7	6-7
a	3	1	6	0	2	3	6	1	2	4
m	4	2	8	0	5	5	9	1	5	8
b	5	3	10	0	8	7	12	1	8	12

i) Draw the Project Network
ii) Find the length and variance of each activity.
iii) Find the critical path.
iv) Find the length and variance of the critical path. **(10)**

18. (i) Define the following Terms:
a) Reorder Level b) Reorder Point **(10)**
c) Safety stock d) Shortage

(ii) A stockiest has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed is to be infinite. The inventory holding cost is Re.0.20 per unit per month and the ordering cost per order is Rs.350. Determine the following

(i) The optimum lot size q_0
(ii) Optimum scheduling period t_0
(iii) Minimum total variable yearly cost. **(10)**

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