



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc.DEGREE EXAMINATION –MATHEMATICS

FIFTH SEMESTER – APRIL 2019

MT 5507– OPERATIONS RESEARCH

Date: 23-04-2019
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

PART-A

Answer all the questions

(10 x 2=20)

1. What is an unbounded solution?
2. Define slack variable in an LPP.
3. Define non-degenerate basic feasible solution in transportation problem.
4. Give the Mathematical formulation of an assignment problem.
5. Define Payoff matrix.
6. Define spanning tree in a network.
7. Define a path and cycle in a network.
8. Define critical path in a network.
9. What is Economic order quantity?
10. Define Lead Time.

PART-B

Answer any FIVE questions

(5 x 8=40)

11. Use the graphical method to solve the LPP. Minimize $Z = 3x_1 + 2x_2$ subject to constraints
(i) $5x_1 + x_2 \geq 10$ (ii) $x_1 + x_2 \geq 6$ (iii) $x_1 + 4x_2 \geq 12$ and $x_1, x_2 \geq 0$
12. What is two person zero sum game in game theory? Define a saddle point. Also explain different types of strategies.
13. Determine an initial basic feasible solution to the following transportation problem by using North West Corner Method.

		Destination				
		D_1	D_2	D_3	D_4	Supply
Source	A	11	13	17	14	250
	B	16	18	14	10	300
	C	21	24	13	10	400
	Demand	200	225	275	250	

14. 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?

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

15. Solve the following game after reducing it to a 2×2 game

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	7	2
	A_2	6	2	7
	A_3	5	1	6

16. Solve the following game by using graphical method and find the value of the game.

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	2	2	3	-2
	A_2	4	3	2	6

17. Construct the arrow diagram comprising activities A, B, \dots and L such that the following relationships are satisfied:

- (i) A, B and C , the first activities of the project, can start simultaneously,
- (ii) A and B precede D
- (iii) B precedes E, F and H ,
- (iv) F and C precede G ,
- (v) E and H precede I and J ,
- (vi) C, D, F and J precede K ,
- (vii) K precedes L ,
- (viii) I, G and L are the terminal activities of the project.

18. A company that deals with hardware products is concerned about its stocks of copper cable. This costs Rs 240 a meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs 1,050 for administration and holding costs are estimated at 25 percent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company?

PART-C

Answer any TWO questions

(2 x 20=40)

19. Use the penalty (Big- M) method to solve the following LP Problem.

Minimize $Z = 5x_1 + 3x_2$ subject to constrains (i) $2x_1 + 4x_2 \leq 12$, (ii) $2x_1 + 2x_2 = 10$,

(iii) $5x_1 + 2x_2 \geq 10$ and $x_1, x_2 \geq 0$.

20. (a) A company has factories at F_1, F_2 and F_3 that supply products to warehouses at W_1, W_2 and W_3 . The weekly capacities of the factories are 200, 160 and 90 units, respectively. The weekly warehouse requirements are 180, 120 and 150 units respectively. The unit shipping costs (in rupees) are as follows:

		Warehouse			Supply
		W_1	W_2	W_3	
Factory	F_1	16	20	12	200
	F_2	14	8	18	160
	F_3	26	24	16	90
	<i>Demand</i>	180	120	150	450

Determine the optimal distribution for this company in order to minimize its total shipping cost. (10)

(b) A travelling salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. The travelling cost (in '000 Rs) of each city from a particular city is given below:

		To City				
		A	B	C	D	E
From City	A	∞	2	5	7	1
	B	6	∞	3	8	2
	C	8	7	∞	4	7
	D	12	4	6	∞	5
	E	1	3	2	8	∞

What should be the sequence of visit of the salesman so that the cost is minimum? (10)

21.(a) Solve the game whose payoff matrix is given below:

Player A		Player B			
		B_1	B_2	B_3	B_4
A_1	3	2	4	0	
A_2	3	4	2	4	
A_3	4	2	4	0	
A_4	0	4	0	8	

(b) A small project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning(*i*) and ending(*j*) node numbers.

Activity (<i>i-j</i>)	Estimated Duration (weeks)		
	Optimistic	Most Likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- (i) Draw the network of the activities in the project
- (ii) Find the expected duration and variance for each activity.
- (iii) What are the expected project length and critical path? **(10)**

22.(a) The production department of a company requires 3,600 kg of raw materials for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs 36 and the cost of carrying inventory is 25 percent of the investment in the inventories. The price is Rs 10 per kg. Help the purchase manager to determine an ordering policy for raw material. **(10)**

- (b) (i) What is shortage cost?
- (ii) What is price break?
- (iii) Define deterministic inventory model.
- (iv) What is holding cost in inventory? **(2+2+4+2)**
