LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

FIFTH SEMESTER – **NOVEMBER 2018**

MT 5507– OPERATIONS RESEARCH

Date: 30-10-2018 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

ART-A

Answer all the questions $(10 \times 2 = 20)$

1. Define surplus variable in an LPP.
2. What is an unbounded solution?
3. Define non-degenerate basic feasible solution in transportation problem.
4. Define an assignment problem.
5. Define Payoff matrix.
6. Define saddle point.
7. Define a network.
8. What is the main difference between CPM and PERT?
9. What is Economic order quantity?
10. Define Lead Time.

PART-B

Answer any FIVE questions $(5 \times 8 = 40)$

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. Prove that the dual of the dual is the primal.
13. Determine an initial basic feasible solution to the following transportation problem by using (a) North West Corner Method (b) Least Cost Method.

Destination

Source	D_1	D_2	D_3	D_4	Supply
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		
Player *A*	B_1	B_2	B_3
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			
Player *A*	B_1	B_2	B_3	B_4
A_1	2	2	3	-2
A_2	4	3	2	6

17. Construct the network diagram of activities for the project listed in the table are the activities and sequencing necessary for a maintenance job on the heat exchangers in a refinery.

Activity	*Description*	*Predecessor Activity*
A	Dismantle pipe connections	--
B	Dismantle heater, closure and floating front	*A*
C	Remove tube bundle	*B*
D	Clean bolts	*B*
E	Clean heater and floating head front	*B*
F	Clean tube bundle	*C*
G	Clean shell	*C*
H	Replace tube bundle	*F,G*
I	Replace shell pressure test	*D,E,H*
J	Prepare tube pressure test and reassemble	*I*

18. A company that operates for 50 weeks in a year 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 replenishments costs Rs 1,050 for administration and Rs 1,650 for delivery, while 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? How would this analysis differ if the company wanted to maximize its profits rather than minimize cost? What is the gross profit if the company sells the cable for Rs 360 a meter?

PART-C

Answer any TWO questions $(2\times 20 = 40)$

19. Use the simplex method to solve the following LP problem. Maximize $z = 3x_1 + 5x_2 + 4x_3$ subject to the constraints, i) $2x_1 + 3x_2 \le 8$, ii) $2x_2 + 5x_3 \le 10$ iii) $3x_1 + 2x_2 + 4x_3 \le 15$ and $x_1, x_2, x_3 \ge 0$.

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 and150 units respectively. The unit shipping costs (in rupees) are as follows:

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

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

(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. Thetravelling 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+10)

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

	Player *B*			
Player *A*	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	*Estimated Duration (weeks)*		
(*i-j*)	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?

(iv) Calculate the standard deviation of the project length.

(10+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.

(b) The annual demand of a product is 10000 units. Each unit costs Rs100 if the orders are placed in quantities below 200 units. For orders of 200 or above, however, theprice is Rs 95.The annual inventory holding costs is 10 percent of the value of the item and the ordering cost is Rs 5 per order. Find the economic lot size**.** **(10+10)**

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