LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIFTH SEMESTER – NOVEMBER 2011

MT 5507/MT 5504 - OPERATIONS RESEARCH

Date : 04-11-2011 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

PART – A

Answer ALL questions: **(10 × 2 = 20)**

1. Define: (i) Basis feasible solution, (ii) Optimum basic feasible solution of a linear programming problem.
2. Write the standard form of the following linear programming problem.

   Minimize $Z = x_2 - 3x_3 + 2x_5$

   subject to the constraints

   $3x_2 - x_3 + 2x_5 \le 7$, $-2x_2 + 4x_3 \le 12$, $-4x_2 + 3x_3 + 8x_5 \le 10$, and $x_2, x_3, x_5 \ge 0$.
3. What is an assignment problem?
4. What is an unbalanced transportation problem? How to balance an unbalanced transportation problem?
5. Define mixed strategy in game theory.
6. Write any two assumptions of the game in game theory.
7. Explain reasons for incorporating dummy activities in a network diagram.
8. Define critical path in a network.
9. What are the important reasons for carrying inventory?
10. What is economic order quantity?

PART – B

(5 × 8 = 40)

Answer any FIVE questions:

11. Use simplex method to solve the following linear programming problem.

    Maximize $Z = 3x_1 + 5x_2 + 4x_3$

    subject to the constrains

    $2x_1 + 3x_2 \le 8$ $2x_2 + 5x_3 \le 10$,

    $3x_1 + 2x_2 + 4x_3 \le 15$ and $x_1, x_2, x_3, \ge 0$.

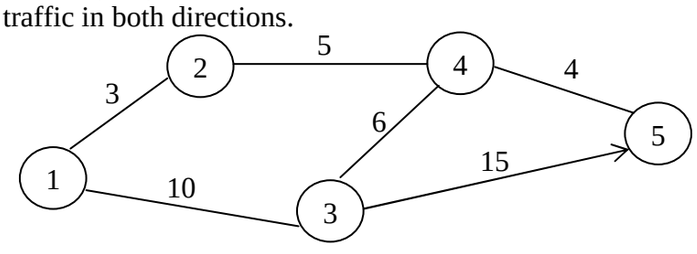
12. Obtain an initial basis feasible solution to the following transportation problem by (i) North-west corner method (ii) Least-cost method.

	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	

13. In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins noting when there are two tails and losses ½ unit of value when there is one head and one tail. Determine the payoff matrix, the best strategies for each player and the value of the game.
14. Use graphical method in solving the following game and find the value of the game.

	B_1	B_2	B_3	B_4
A_1	4	-2	3	-1
A_2	-1	2	0	1

15. For the network given below, find the shortest route between every two nodes. The distances (in miles) are given on arcs. Arc (3, 5) is directional so that no traffic is allowed from node 5 to node 3. All the other arcs allow traffic in both directions.



16. Tasks *A, B, . . ., H, I* constitute a project. The notation $x < y$ means that the task x must be finished before y can begin. With this notation, $A < D$, $A < E$, $B < F$, $D < F$, $C < G$, $C < H$, $F < I$, $G < I$. Draw a graph to represent the sequence of tasks and find the minimum time of completion of the project, when the time (in days) of completion of each task is as follows:

Tasks:	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Time:	8	10	8	10	16	17	18	14	9

17. The demand for a particular item is 18,000 units per year. The holding cost per unit is Rs. 1.20 per year, and the cost of one procurement is Rs. 400. No shortages are allowed, and the replacement rate is instantaneous. Determine
    (a) Optimal order quantity,
    (b) Number of orders per year,
    (c) Time between orders, and
    (d) Total cost per year when the cost of one unit is Re. 1.
18. The annual demand of a product is 10,000 units. Each unit costs Rs. 100 if orders placed in quantities below 200 units but for orders of 200 or above the price is Rs. 95. The annual inventory holding costs is 10 per cent of the value of the item and the ordering cost is Rs. 5 per order. Find the economic lot size.

PART – C

($2 \times 20 = 40$)

Answer any TWO questions:

19. (i) A person requires 10, 12 and 12 units of chemicals *A, B* and *C* respectively for his garden. A liquid product contains 5, 2 and 1 units of *A, B* and *C* respectively per jar. A dry product contains 1, 2, and 4 units of *A, B* and *C* per carton. If the liquid product sells for Rs. 3 per jar and dry product sells for Rs. 2 per carton, how many of each should he purchase in order to minimize the cost and meet the requirements? (Use graphical method)

    (ii) Use dual simplex method to solve the following linear programming problem.

    Minimize $Z = x_1 + 2x_2 + 3x_3$
    subject to the constraints
    $x_1 - x_2 + x_3 \geq 4$, $x_1 + x_2 + 2x_3 \leq 8$, $x_1 - x_3 \geq 4$ and $x_1, x_2, x_3 \geq 0$. [10+10]

20. (i) A company has factories at F_1, F_2 and F_3 which supply to warehouses at W_1, W_2 and W_3. Weekly factory capacities are 200, 160 and 90 units, respectively. Weekly warehouse requirements are 180, 120 and 150, respectively. Unit shipping costs (in rupees) are as follows:

warehouse / Factory	W_1	W_2	W_3	Supply
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 to minimize total shipping cost.

    (ii) A department has five employees with five jobs to be performed. The time (in hours) each man will take to perform each job is given in the effectiveness matrix.

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

    How should the jobs be allocated, one per employee, so as to minimize the total man-hours?

    [10+10]

21. (i) For the following pay-off table, find the strategy and the value of the game.

		Player Q		
		Q_1	**Q_2**	**Q_3**
Player P	**P_1**	9	1	4
	P_2	0	6	3
	P_3	5	2	8

(ii) The following network diagram represents activities associated with a project:

Activities :	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Optimistic time:	5	18	26	16	15	6	7	7	3
Pessimistic time:	10	22	40	20	25	12	12	9	5
Most likely time:	8	20	33	18	20	9	10	8	4

Determine the following:

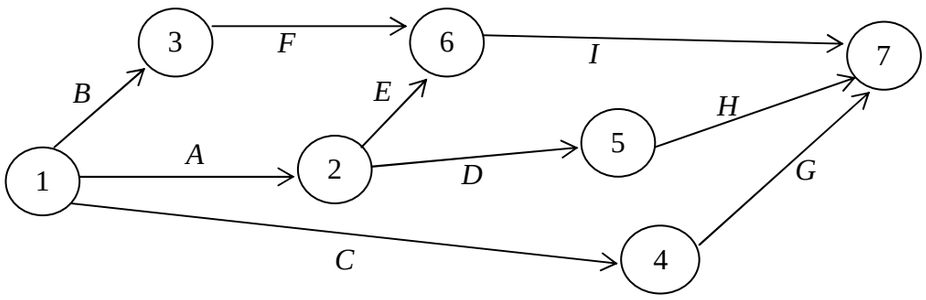
(i) Expected activity time and variance.

(ii) The earliest and latest completion times of each event.

(iii) The critical path.

(iv) The probability of expected completion time of the project if the original scheduled time of completing the project is 41.5 weeks.

(v) The duration of the project that will have 95 per cent chance of being completed.



[10+10]

22. Explain the EOQ model with constant demand and variable Order cycle time with shortages.

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