M.B.A. Semester – I Examination
Paper – 107: Operations Research (Code: 3125)

Time: 2½ Hours   **Max.Marks: 70**

Q.1(a) A company sells two different products A and B. The two products are produced in a common production process and are sold in two different markets. The production process has a total capacity of 45,000 man-hours. It takes 5 hours to produce a unit of A and 3 hours to produce a unit of B. The market has been surveyed and company officials feel that the maximum number of units of A that can be sold is 7,000 and that of B is 10,000. The profit for the product A is Rs. 600 per unit and Rs. 400 per unit for the product B. Company wants to maximize the profit. Formulate this problem as a linear programming model.   [7]

Q.1(b) Explain the structure of Linear Programming model.   [7]

OR

Q.1(a) Use graphical method to maximize the profit $Z = 80x_1 + 120x_2$ subject to the constraints $x_1 + x_2 \le 9, 20x_1 + 50x_2 \le 360, x_1 \ge 2, x_2 \ge 3$ and $x_1, x_2 \ge 0$.   [7]

Q.1(b) Write dual of the following primal LP problems: [7]

    (i)   Maximize $Z_x = 120x_1 + 30x_2 + 10x_3$
             Subject to $10x_1 + 2x_2 + x_3 \le 100, 7x_1 + 3x_2 + 2x_3 \le 77,$
             $2x_1 + 4x_2 + x_3 \le 80$ and $x_1, x_2, x_3 \ge 0$.

    (ii)   Minimize $Z_x = 6000x_1 + 4000x_2$
             Subject to $4x_1 + x_2 \ge 12, 9x_1 + x_2 \ge 20, 7x_1 + 3x_2 \ge 18,$
             $10x_1 + 40x_2 \ge 40$ and $x_1, x_2 \ge 0$.

Q.2(a) "The assignment problem is a special case of transportation problem". Justify.   [7]

Q.2(b) Write down steps of MODI method.   [7]

OR

Q.2(a) Determine an initial basic feasible solution to the following transportation problem by using (i) North West Corner Method, (ii) Least Cost Method.   [7]

	D1	D2	D3	D4	Supply
S1	21	16	25	13	11
S2	17	18	14	23	13
S3	32	27	18	41	19
Demand	6	10	12	15	

Q.2(b) A company is producing a single product and is selling it through five agencies [7]
situated in different cities. All of a sudden, there is a demand for the product in
another five cities not having any agency of the company. The company is
faced with the problem of deciding on how to assign the existing agencies to
dispatch the product to needy cities in such a way that the travelling distance is
minimized. The distances (in kms.) between the surplus and deficit cities are
given in the following distance matrix. Determine the optimal assignment
schedule.

Deficit Cities

		I	II	III	IV	V
Surplus Cities	A	160	130	175	190	200
	B	135	120	130	160	175
	C	140	110	155	170	185
	D	50	50	80	80	110
	E	55	35	70	80	105

Q.3(a) The following table gives the running costs per year and resale values of a [7]
certain equipment whose purchase price is Rs. 65,000. At what year is the
replacement due optimally?

Year:	1	2	3	4	5	6	7	8
Running Cost	14000	15000	17000	20000	24000	28000	33000	39000
Resale Value	40000	30000	22000	17000	13000	10000	10000	10000

Q.3(b) Draw a Network diagram for the following project: [7]

Activity	A	B	C	D	E	F	G	H
Predecessor Activity	--	--	A	A	B	C	D, E	F,G

OR

Q.3(a) What is PERT and CPM? Explain major components of PERT/CPM network. [7]

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Q.3(b) Find critical path from the following Network diagram. Figures on arrow lines [7]
indicate the duration in hours.
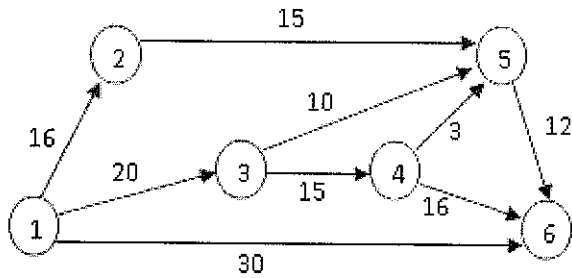
Q.4(a) Discuss various types of decision making environment. [7]

Q.4(b) Solve the game whose payoff matrix is given below. Determine the strategy [7]
that define the saddle point and also find value of the game.

Player - B

		B1	B2	B3	B4
Player-A	A1	16	–60	56	–58
	A2	–20	28	–18	–24
	A3	24	–8	0	–24

OR

Q.4(a) What is two person zero sum game? How to find saddle point and value of the [7]
game?

Q.4(b) Given is the following payoff matrix: [7]

States of Nature	Probability	Courses of Action		
		A1: Do not expand	A2: Expand 200 units	A3: Expand 400 units
S1: High demand	0.4	2500	3500	5000
S2: Medium demand	0.4	2500	3500	2500
S3: Low demand	0.2	2500	1500	1000

What should be the decision if we use (i) Optimistic criterion (ii) Pessimistic
criterion (iii) Optimistic regret criterion and (iv) Pessimistic regret criterion?

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Q.5(a) Find the sequence that minimizes the total elapsed time and processing time in [7] hours required to complete the following jobs. Also compute idle time for both machines.

Job:	A	B	C	D	E	F	G
Machine I:	6	24	30	12	20	22	18
Machine II:	16	20	20	12	24	2	6

Q.5(b) A bakery keeps stock of a popular brand of cake. Previous experience shows [7] the daily demand pattern for the item with associated probabilities, as given below:

Daily demand	0	10	20	30	40	50
Probability	0.01	0.20	0.15	0.50	0.12	0.02

Use random number sequence 48, 78, 19, 51, 56, 77, 15, 14, 68, 9 to simulate the demand for next 10 days. Also estimate the daily average demand for the cakes on the basis of the simulated data.

OR

Q.5(a) Explain Johnson's method to solve sequencing problem of n-jobs through two [7] machines.

Q.5(b) Find the sequence that minimizes the total time required in performing the [7] following jobs on three machines in the order ABC. Processing time, in hours, are given in the following table. Also find the total elapsed time.

Job:	1	2	3	4	5	6
Machine A:	6	24	10	4	18	22
Machine B:	16	12	8	12	6	2
Machine C:	26	28	18	24	16	26

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