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

Time: 2½ Hours **Max.Marks: 70**

Q.1(a) The manager of an oil refinery must decide on the optimal mix of two possible blending processes of which the input and output per production run are given as follows: [6]

Process	Input (units)		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	5	3	5	8
2	4	5	4	4

The maximum available amount of crude A and B are 200 units and 150 units respectively. Market requirements show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profit per production run from process 1 and process 2 are Rs. 300 and Rs. 400 respectively. Formulate this problem as an LP model to maximize profit.

Q.1(b) Explain the following terms of Linear Programming Problems: [8]

(i) Decision variables (ii) Objective function (iii) Constraints
(iv) Basic solution

OR

Q.1(a) Use graphical method to maximize the profit $Z = 50x + 18y$, subject to the constraints $2x + y \leq 100$, $x + y \leq 80$ and $x, y \geq 0$. [7]

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

(i) Maximize $Z = 75x_1 + 20x_2$
Subject to $x_1 \leq 30$, $x_2 \leq 35$, $2x_1 + x_2 \leq 80$ and $x_1, x_2 \geq 0$

(ii) Minimize $Z = 7x_1 + 3x_2 + 8x_3$
Subject to $8x_1 + 2x_2 + x_3 \geq 3$, $3x_1 + 6x_2 + 4x_3 \geq 4$ and $x_1, x_2, x_3 \geq 0$

Q.2(a) Write an algorithm to obtain optimum solution of a transportation problem. [7]

Q.2(b) Obtain initial solution for the following transportation problem using Vogel's Approximation Method: [7]

	D1	D2	D3	D4	Supply
S1	21	16	15	3	11
S2	17	18	14	23	13
S3	32	27	18	41	19
Demand	6	6	8	23	

OR

Q.2(a) A construction company has requested bids for subcontracts on five different projects. Five companies have responded. Their bids are represented below. Apply Hungarian method to determine the minimum cost assignment of subcontracts to bidders, assuming that each bidder can receive only one contract. [7]

		Bid Amounts ('000s Rs.)				
		I	II	III	IV	V
Bidders	A	41	72	39	52	25
	B	22	29	49	65	81
	C	27	39	60	51	40
	D	45	50	48	52	37
	E	29	40	45	26	30

Q.2(b) 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	1	2	1	4	30
S2	3	3	2	1	30
S3	4	2	5	9	40
Demand	20	40	30	10	

Q.3(a) What is PERT and CPM? Explain phases of project management. [7]

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

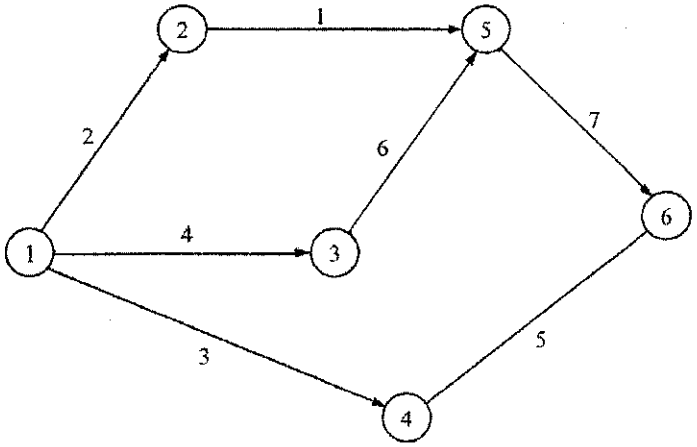
Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Predecessor Activity	--	A	A	C	B	C	D, E	G	H	F	I	K	L	J	M, N

OR

Q.3(a) The cost price of a machine is Rs. 12,200 and its scrap value is Rs. 300. The running cost of this machine is given in following table. Determine when should the machine be replaced? [7]

Year:	1	2	3	4	5	6	7	8
Running Cost	300	550	900	1300	1800	2400	3200	4000

Q.3(b) Find critical path from the following Network diagram. Figures on arrow lines indicate the duration in hours. [7]



Q.4(a) Write down the steps involved in decision theory approach and explain the decision making environment under risk. [7]

Q.4(b) Following pay-off matrix of a game has a pure strategy solution. Determine the strategy that define the saddle point and also find value of the game. [7]

	B1	B2	B3	B4	B5
A1	3	–1	4	6	7
A2	–1	8	2	4	12
A3	16	8	6	14	12
A4	1	11	–4	2	1

OR

Q.4(a) Explain the terms of Game theory: [7]

(i) Players (ii) Saddle point (iii) Pay-off (iv) Mixed Strategy.

Q.4(b) Suppose the following data is known for a toy manufacturing company. Determine the optimal decision under the decision criteria: [7]

(i) Maximax (ii) Maximin and (iii) Equal likelihood.

Anticipated Profit (in '00 Rs)

Product line

Product Acceptance	Full	Partial	Minimal
Good	8	70	50
Fair	50	45	40
Poor	–25	–10	0

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

Job:	1	2	3	4	5	6
Machine A:	4	8	3	6	7	5
Machine B:	6	33	7	2	8	4

Q.5(b) A confectioner sells confectionery items. Past data of demand per week (in hundred kilograms) with their probability is given below: [7]

Weekly demand	5	10	15	20	25
Probability	0.85	0.03	0.09	0.02	0.01

Use random number sequence: 35, 52, 90, 13, 23, 93, 34, 57, 35, 83, 94, 56, 97, 66, 60 to simulate the demand for the next 15 weeks. Also estimate the weekly average demand.

OR

Q.5(a) Discuss applications of simulation. [7]

Q.5(b) Find the sequence that minimizes the total time required in performing the 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. [7]

Job:	1	2	3	4	5
Machine A:	8	10	6	7	11
Machine B:	5	6	2	3	4
Machine C:	4	9	8	6	5
