

B. E. PRODUCTION ENGG. 3RD YEAR 2ND SEMESTER EXAMINATION 2025
OPERATIONS RESEARCH

Ex/PROD/PC/H/T/326/2025

Time: Three hours

Full marks: 100

Question No. (1) is compulsory. Then answer any five from the remaining.

- 1.(a) State the assumptions of a two-person-zero-sum game. Define value of a game, a saddle point and a fair game? (4+3×2)
(b) In Monte Carlo simulation, state how the random numbers are generated. (5)
(c) With illustrative examples, classify integer programming problems. (5)
(d) What is a decision? Differentiate between decision under uncertainty and decision under risk. (2+3)
(e) Classify a queue system based on the customer's behavior. (5)
2. A modern home appliance dealer finds that the cost of holding a mini cooking range in stock for a month is Rs. 200 (insurance, minor deterioration, interest on borrowed capital etc.). Customers who cannot obtain a cooking range immediately tend to go to other dealers and he estimates that for every customer who cannot get immediate delivery, he loses an average of Rs. 500. The probabilities of a demand of 0, 1, 2, 3, 4 and 5 mini cooking ranges in a month are 0.05, 0.10, 0.20, 0.30, 0.20 and 0.15, respectively. Determine the optimal stock level of the cooking ranges. Also compute the EVPI. (14)
3. A stereo equipment manufacturer can produce two models, A and B of 40 and 80 watts of total power, each. Each model passes through three manufacturing divisions, namely 1, 2 and 3, where model A takes 4, 2.5 and 4.5 hours each and model B takes 2, 1 and 1.5 hours each. The three divisions have maximum of 1600, 1200 and 1600 hours available every month, respectively. Model A gives a profit contribution of Rs. 400 and model B of Rs.100 each. Assuming abundant product demands, formulate and solve the problem as an integer LP problem, and determine the optimal product mix and maximum contribution. (14)
4. A transistor radio company manufactures four models A, B, C and D. Models A, B and C have profit contributions of Rs. 8, 15 and 25 respectively, and model D has a loss of Rs. 1. Each type of radio requires a certain amount of time for manufacturing of the components, for assembling and for packaging. A dozen units of model A require one hour for manufacturing, two hours for assembly and one hour for packaging. The corresponding figures for a dozen of model B are 2, 1 and 2, and for a dozen of model C are 3, 5 and 1. A dozen units of model D however only require 1 hour of packing. During the forthcoming week, the company will be able to make available 15 hours of manufacturing, 20 hours of assembling and 10 hours of packing time. Determine the optimal production schedule. (14)
5. The conclusion of an analysis of voting trends in certain state is that the voting patterns of successive generations are described by the following matrix:

	Party A	Party B	Party C
Party A	80%	15%	5%
Party B	20%	70%	10%
Party C	60%	30%	10%

Construct a stochastic matrix that defines a Markov chain model of these voting patterns. If there are 2.5 million who believe in Party A, 1.5 million in Party B and 0.25 million in Party C at a certain period, what is the distribution likely to be in the next generation? (14)

6. A manufacturer has distribution centers located at Agra, Allahabad and Kolkata. Three centers have available of 40, 20 and 40 units of his product. His retail outlets at A, B, C, D and E require 25, 10, 20, 30 and 15 units if the product. The shipping cost per unit (in Rs.) between each center and outlet is given in the following table:

[Turn over

Center	Retail outlet				
	A	B	C	D	E
Agra	55	30	40	50	40
Allahabad	35	30	100	45	60
Kolkata	40	60	95	35	30

Determine the optimal shipping cost.

(14)

7. A company trading in motor vehicle spare parts wishes to determine the levels of inventory it should carry for the items in its range. The demand is not certain and there is a lead time for the item replenishment. For an item A, the following information is obtained:

Demand (units/day): 3 4 5 6 7
Probability: 0.10 0.20 0.30 0.30 0.10

Carrying cost(per unit/day): Rs. 2

Ordering cost (per order): Rs. 50

Lead time for replenishment: 3 days

Stock on hand at the beginning of the simulation exercise was 20 units. Carry out a simulation run over a period of 10 days with the objective of evaluating the inventory cost. Order 15 units when the present inventory plus any outstanding order falls below 15 units. You may use random numbers in the sequence of 0, 9, 1, 1, 5, 1, 8, 6, 3, 5, 7, 1, 2, 9, taking the first number for day one. Your calculation should include the total cost of operating this inventory for the 10 days.

(14)

8. Obtain the strategies for both players and the value of the game for the following two-person zero-sum game whose pay-off matrix is given as follows:

(14)

Player A	Player B					
	B ₁	B ₂	B ₃	B ₄	B ₅	B ₆
A ₁	1	3	-1	4	2	-5
A ₂	-3	5	6	1	2	0