PG (CBCS) Even Semester Examination, May 2025

STATISTICS

4th Semester

Course No. : STSCC - 403

(Industrial Statistics and Optimization Techniques-I)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions taking one from each unit)

Unit - I

1. (a) Explain linear programming problem and state its assumptions. Define slack variable, surplus variable and artificial variable with examples. 3+4=7

(b) A company produces two types of presentable goods A and B that require gold and silver. Each unit of type A requires 3 grams of silver and 1 gram of gold while each unit of type B requires 1 gram of silver and 2 gram of gold. The company can produce 9 grams of silver and 8 grams of gold. If each unit of type A and type B brings a profit of Rs. 400 and Rs. 500, determine the number of units of each type that should be

(Turn Over)

produced to maximize the profit? Use graphical method to solve the problem. 7

2. (a) Solve the following linear programming problem using simplex method. 7

Maximize $z = 2x_1 + x_2$

Subject to the constraints

$$4x_1 + 3x_2 \le 12$$
$$4x_1 + x_2 \le 8$$
$$4x_1 - x_2 \le 8$$
and $x_1 \ge 0, \ x_2 \ge 0$

(b) Solve the following linear programming problem using Big M-method or two-phase method 7

Minimize $z = 3x_1 + 2x_2$

Subject to the constraints

$$2x_1 + x_2 \ge 4$$
$$x_1 + 7x_2 \ge 7$$
and $x_1 \ge 0 , x_2 \ge 0$

Unit - II

3. (a) Briefly mention at least four areas of applications of network techniques. Explain the significance of PERT and CPM. 4+3=7

(b) Describe the following terms in PERT with examples 3+2+2=7

(i) Three time estimates

(ii) Expected time estimate

(iii) Activity variance

(b) An item sells for Rs. 25 per unti and cost Rs. 10, unsold items can be sold for Rs. 4 each. It is assumed that there is no shortage cost besides the lost revenue. The demand is known to be any value between 600 and 1000 items. Determine the optimal number of units of the item to be stocked? 4

Unit - V

9. (a) Describe the transportation problem with an example. Explain the difference between a transporation problem and an assignment problem. 4+3=7

(b) Describe Hungarian method of solving assignment problem. 7

10. (a) Show that the necessary and sufficient condition for the existence of feasible solution of an mxn transportation problem is 7

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$$

where the symbols have their usual meanings.

(b) Write short notes on the following: 4+3=7

(i) Degeneracy in transportation problem

(ii) Restricted assignment problem

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4. (a) A project has the following activities and their time durations.

Activity :	1-2	1-3	2-3	2-5
Duration :	15	15	3	5
Activity :	3-4	3-6	4-5	4-6
Duration :	8	12	1	14
Activity :	5-6	6-7		
Duration :	3	14		

(i) Draw the network diagram for the project.

(ii) Identify the critical path and its duration. 4+3=7

(b) A small project involves 7 activities and their time estimates are listed in the following table. Activities are identified by their beginning (i) and ending (j) node :

	Estimated duration (weeks)		
Activity	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 diagram of the activities in the project

(ii) Find the expected duration and variance of each activity. What is the expected project length? 3+4=7

Unit - III

5. (a) Describe the EOQ model without shortage for economic lot size of the system having uniform demand. 7

(b) Define the word 'inventory'. Why we need inventory? What are the advantages and disadvantages of inventory. 1+2+4=7

6. (a) What are the costs in inventory control? Describe the costs of inventory with examples. 2+5=7

(b) What are the controlled and uncontrolled variables in inventory control. Explain these variables with examples. 3+4=7

Unit - IV

7. (a) Describe the single period discrete probability demand model in inventory. 10

(b) Why probabilistic inventory models are more useful than deterministic inventory models. 4

8. (a) Describe the single period continuous probability demand model for inventory control. 10