Paper Code : 21866

B. Sc. Sem. VI, Exam..)
STAT–CC–606
Advanced Operations Research Techniques

Time::$2\frac{1}{2}$ Hours   Marks: 70

Instructions:
1. There are FIVE compulsory Questions in this paper. Each question carries 14 marks.
2. Graph Papers will be provided on request.
3. Use of scientific calculator is allowed.

Q 1. a) Define the following terms of L. P. P.:   6
         1) Objective function,
         2) Constraints, &
         3) Decision Variables.

    b) A farm is engaged in breeding Pigs. The pigs are fed on various products grown 8
on the farm .In view of the need to ensure certain nutrient constituents. It is necessary to buy two products per unit ,in nutrient constituents(In vitamins, proteins, etc) is given in the following table.

Nutrients	Nutrient Content In product		Minimum quantity Required
	A	B	
M_1	36	6	108
M_2	3	12	36
M_3	20	10	100

If the product A and B cost Rs.20 and Rs.40 per unit respectively how much each of these two products should be bought so that the total cost is minimized.
      (i) Formulate this problem as an L.P. Model.

      (ii) Write and solve the duality of the above L.P.P. Hence find optimal solution of primal problem.
<div align="center">OR</div>

Q 1. a) Give the relationship between primal and dual linear programming problem.   5

    b) Solve the following L.P.P. using Two Phase Method.   9
       Min $Z = 12x_1 + 18x_2 + 15 x_3$
           Subject to Constraints : $4x_1 + 8x_2 + 6x_3 \geq 64$
                          $3x_1 + 6x_2 + 12x_3 \geq 96$
                          $x_1 \geq 0 , x_2 \geq 0 , x_3 \geq 0$

Q 2. a) Describe MODI Method of finding optimal basic feasible solution.   6

b) Solve the following Assignment problem to maximize the score. 8

Semesters	Subjects			
	O. R.	Mathematical Statistics	Graph Theory	Topology
I	41	47	43	48
II	42	44	45	46
III	43	45	48	44
IV	44	46	40	42

OR

Q 2. a) What is Assignment Problem? Explain Hungerian method for solving assignment problem. 6

b) The following data represents the cost of transporting specific pediatric drug from four different manufacturers A, B, C, and D to 5 chemists C_1, C_2, C_3, C_4 and C_5. The availability of manufactures and requirements of the five chemists are table given on the next page. Find an initial basic feasible solution to the given TP using Vogel's Approximation methods. 8

Origin	Chemists					Supply
	C_1	C_2	C_3	C_4	C_5	
A	3	4	6	8	9	20
B	2	10	1	5	8	30
C	7	11	20	40	8	15
D	2	1	9	14	16	13
Demand	40	6	8	18	6	

Q3 a) Define the following giving 8
   i. Strategy   ii. Optimal Strategy
   iii. Pure Strategy   iv. Mixed Strategy.

b) Solve the following game whose pay-off matrix is given by 6

Player A	Player B				
	B_1	B_2	B_3	B_4	B_5
A_1	9	3	1	8	0
A_2	6	5	4	6	7
A_3	2	4	3	3	8
A_4	3	6	2	2	1
A_5	3	6	2	2	1

OR

Q3 a) 1) Define the following giving: 6
   i) value of the game
   ii) pay-off Matrix
   2) Explain the theory of dominance in the solution of a rectangular game.

b) Solve the following game whose payoff matrix is given below. Find the optimal strategy and the value of the game. **8**

Union Strategies	Company Strategies			
	I	II	III	IV
I	20	15	12	35
II	25	14	8	10
III	40	2	10	5
IV	-5	4	11	0

Q.4 a) Define the following terms in network analysis - **6**
i. Network, ii. Activity, iii. Critical Path.

b) The expected times in months and variances for the activities of a PERT network are given below. **8**

Activities	1-2	1-3	2-4	2-5	3-4	3-6	4-5	4-6	5-7	6-7
Expected Time	4	5	2	12	3	8	10	6	8	10
Variance	8	3	1	5	2	4	4	2	1	8

i) Draw a PERT-Network diagram for the project
ii) Determine the slack time for each event and the critical path
iii) If the scheduled completion time is 32 months, find the probability of completion on schedule. **[P { 0 < Z < 1.90 } = 0.4713]**

OR

Q4. a) What do you mean by Critical Path? Explain 'Forward pass method' and 'Backward pass method' for finding Earliest & Latest Occurrence Time of events. **6**

b) The utility data for a network are given below .Determine the time of completion of the project and critical path. **8**

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

Q. 5 a) Explain 'Monte Carlo Simulation' technique. **6**

b) A fleet owner finds from his past records that the costs per year of running an auto whose purchase price is Rs. 60,000 are as given below: **8**

Year	1	2	3	4	5	6	7	8
Running costs Rs.	10000	12000	14000	18000	23000	28000	34000	40000
Resale price Rs.	30000	15000	7500	3750	2000	2000	2000	2000

Determine at what age its replacement due?

OR

Q. 5 a) What is replacement? State some important replacement situations. **6**

b) A dealer sells a particular model of washing machine for which the probability distribution of daily demand is as given in Table – **8**

Demand /day	0	1	2	3	4	5
Probability	0.05	0.25	0.20	0.25	0.10	0.15

Find the average demand of washing machines per day.