

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1471

F-7

Your Roll No.....

Unique Paper Code : 2371301

Name of the Paper : Operational Research

Name of the Course : B.Sc. (H) Statistics (Erstwhile FYUP)

Semester : III

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on the receipt of this question paper.
2. Attempt any five questions.
3. Use of simple calculator is allowed.

SECTION A

1. A company makes three products X, Y and Z out of three raw materials A, B and C. The number of units of raw materials required to produce one unit of product is as given in the following table :

	X	Y	Z
A	1	2	1
B	2	1	4
C	2	5	1

The unit profit contribution of the products X, Y and Z are 40, 25 and 50 respectively. The number of units of raw materials available are 36, 60 and 45 respectively.

- (i) Formulate the l.p.p.
- (ii) Solve the formulated l.p.p. so as to maximize the total profit.
- (iii) Write dual of the above problem and obtain its solution from the optimal primal table.

(3,8,4)

P.T.O.

2. (a) Solve the following L.P.P. :

$$\text{Maximize } Z = x_1 + 2x_2 + 3x_3 - x_4$$

subject to the constraints :

$$x_1 + 2x_2 + 3x_3 = 15$$

$$2x_1 + x_2 + 5x_3 = 20$$

$$x_1 + 2x_2 + x_3 + x_4 = 10$$

$$x_1, x_2, x_3, x_4 \geq 0.$$

- (b) Players A and B match coins. If the coins match, then A wins two units of value, if the coins do not match, then B wins 2 units of value. Formulate the payoff matrix and obtain the optimal strategies of both the players. (9,6)

3. (a) Discuss the effect of adding a new non-negative variable x_k in the given l.p.p.:

$$\text{Max. } z = 3x_1 + 4x_2 + x_3 + 7x_4$$

subject to the constraints :

$$8x_1 + 3x_2 + 4x_3 + x_4 \leq 7$$

$$2x_1 + 6x_2 + x_3 + 5x_4 \leq 3$$

$$x_1 + 4x_2 + 5x_3 + 2x_4 \leq 8$$

$$x_j \geq 0; j = 1, 2, 3, 4.$$

It is given that the coefficient of x_k in the constraints are 2,7 and 3 respectively and the cost component associated with x_k is 5.

- (b) A bakery keeps stock of popular brand of bread. Previous experience indicates the daily demand as given below :

Daily demand	0	10	20	30	40	50
Probability	0.01	0.2	0.15	0.50	0.12	0.02

Consider the following sequence of random numbers :

48, 78, 19, 51, 56, 77, 15, 14, 68, 9.

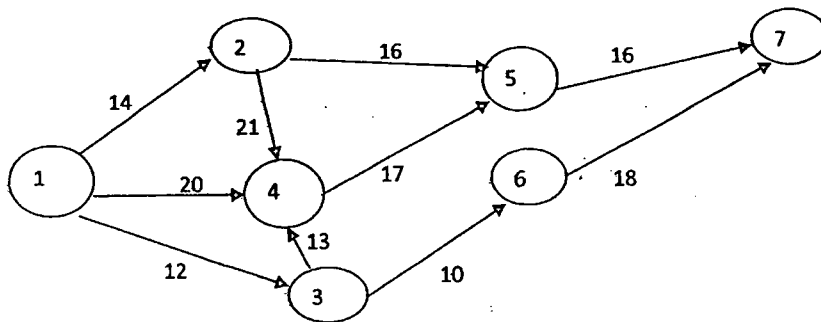
Using the above sequence, simulate the demand for next 10 days. Find out the stock situation if the owner of the bakery decides to make 30 breads everyday. (9,6)

SECTION B

4. (a) Five salesmen are to be assigned to five territories. Based on the past performance, the following table shows the quarterly sales (in million rupees) that can be generated by each salesman in each territory. Find the optimal assignment.

Salesman	Territory				
	T1	T2	T3	T4	T5
S1	3	8	2	10	3
S2	8	7	2	9	7
S3	6	4	2	7	5
S4	8	4	2	3	5
S5	9	10	6	9	10

- (b) A marketing executive had to drive daily between his residence and distant place of work. Due to heavy traffic on roads during the peak hours it became difficult for him to drive. He decided to approach a radio taxi company but before doing that he decided to determine the shortest route to the work place from his residence. The following net work gives the permissible routes and their distances in kms. between his residence (node 1) and six places (node 2 to node 7). Determine the shortest route and the shortest distance from his residence (node 1) to the work place (node 7).



(9,6)

P.T.O.

5. (a) A state has four government hospitals A, B, C and D. Their monthly requirements of medicines are met by four distribution centres X, Y, Z and W. The data in respect of a particular item vis-a-vis availabilities at the centres, requirements at the hospitals and the distribution cost per unit (in paise) are given below :

Warehouse	Hospital				Availability
	A	B	C	D	
X	44	84	84	80	2000
Y	92	30	64	80	12000
Z	32	100	96	72	5000
W	80	36	120	60	6000
Requirement	8000	8000	6000	3000	25000

Determine the optimum distribution.

- (b) Solve the following game :

	Player B				
	B1	B2	B3	B4	
Player A	A1	5	-10	9	0
	A2	6	7	8	1
	A3	8	7	15	2
	A4	3	4	-1	4

(9,6)

6. Write short notes on the following :

- (i) Sensitivity Analysis
- (ii) Duality in linear programming problem
- (iii) Simulation

(5,5,5)