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Your Roll No. ....

**B.A. Prog. / I**

**D**

**OPERATIONAL RESEARCH**

Paper I – Foundations of Operational Research

(Admissions of 2004 and onwards)

*Time : 3 Hours*

*Maximum Marks : 75*

*(Write your Roll No. on the top immediately  
on receipt of this question paper.)*

*All Sections are compulsory and have equal marks.  
Attempt any two parts from each section.*

**SECTION – I**

1. (a) Discuss Operational Research as an interdisciplinary approach. Discuss its scope and limitations.
  
- (b) Wild West produces two types of cowboy hats. A type 1 hat requires twice as much labor time as a type 2. If all the available labor time is dedicated to type 2 alone, the company can produce a total of 400 type 2 hats a day. The respective market limits for the two types are 150 and 200 hats per day. The profit is Rs. 8/- per type 1 hat and Rs. 5/- per type 2 hat. Formulate this problem as

P.T.O.

a linear programming problem, to determine the number of hats of each type that would maximize profit.

- (c) Explain the various phases of solving an Operational Research problem.

### SECTION - II

2. (a) Show that the vectors  $(1,1,0)$ ,  $(2,1,1)$  and  $(3,0,3)$  in  $R^3$  are linearly dependent.

- (b) Find the eigen values and eigen vector of

$$\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

- (c) Find the inverse of the matrix

$$\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 1 & 2 & 4 \end{pmatrix}$$

### SECTION - III

3. (a) Prove that the hyperplane is a convex set.

- (b) Prove the following :

If the convex set of feasible solutions of the system of equations  $Ax = b$ ,  $x \geq 0$ , is a convex polyhedron, then at least one of the extreme points gives an optimal solution.

- (c) Determine all possible basic feasible solutions and check whether they are degenerate or non-degenerate for the following set of equations

$$11x_1 + 2x_2 - 9x_3 + 4x_4 = 6$$

$$15x_1 + 3x_2 - 12x_3 + 5x_4 = 9$$

### SECTION - IV

4. (a) Define arithmetic mean and median and discuss their merits and demerits.
- (b) Calculate Karl Pearson's coefficient of skewness from the following data :

Class	Frequency	Class	Frequency
0-10	11	40-50	21
10-20	22	50-60	11
20-30	30	60-70	6
30-40	35	70-80	5

- (c) In a group of equal number of men and women, 10% men and 45% women are unemployed. What is the probability that a person selected at random is employed ?

### SECTION - V

5. (a) A box contains 'a' white balls and 'b' black balls, 'c' balls are drawn at random. Find the expected value of the number of white balls drawn.

- (b) In a distribution exactly normal, 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution ?
- (c) With usual notations, find  $p$  for a binomial variate  $X$ , if  $n = 6$ , and  $9 P(X=4) = P(X=2)$ .

### SECTION - VI

6. (a) Derive Poisson distribution as the limiting case of Binomial distribution.
- (b) A computer while calculating correlation coefficient between variables  $X$  and  $Y$  from 25 pairs of observations obtained the following results :  
 $n = 25$ ,  $\sum X = 125$ ,  $\sum X^2 = 650$ ,  $\sum Y = 100$ ,  
 $\sum Y^2 = 460$ ,  $\sum XY = 508$ .  
 It was however later discovered at the time of checking that he had copied down two pairs  $(X, Y)$  as  $(6, 14)$ ,  $(9, 16)$ , while the correct values were  $(8, 12)$ ,  $(6, 8)$ . Obtain the correct value of correlation coefficient.
- (c) A sample of 900 members has a mean 3.4 cms and std. dev. 2.61 cms. Is the sample from a large population of mean 3.25 cms and std. dev. 2.61 cms ?

If the population is normal and its mean is unknown, find the 95% and 98% fiducial limits of true mean.