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FACULTY OF SCIENCE

**B.Sc. (Third Year) (Fifth Semester) EXAMINATION**

JUNE/JULY, 2022

(CBCS/Old Pattern)

MATHEMATICS

Paper XIV

(Operation Research)

**(Monday, 20-6-2022)**                                 **Time : 10.00 a.m. to 12.30 p.m.**

*Time—2½ Hours*                                                    *Maximum Marks—40*

N.B. :— (*i*)   *All* questions are compulsory.

   (*ii*)   Figures to the right indicate full marks.

1.   Let us assume that you have inherited ₹ 1,00,000 from your father-in-law that can be invested in a combination of only two stock portfolios with the maximum investment allowed in either portfolio set at ₹ 75,000. The first portfolio has average rate of return of 10% whereas the second has 20%. In terms of risk factors associated with these portfolios, the first has a risk rating of 4 (on scale from 0 to 10) and second has 9. Since you wish to maximize your return, you will not accept average rate of return below 12% or risk factor above 6. Hence, you then face the important question. How much you should invest in each portfolio.

   Formulate this as linear programming problem and solve it by graphical method.                                                                                      15

*Or*

   (*a*)   Explain the major steps for mathematical formulation of linear programming problem and state any *three* basic assumptions necessary for all linear programming problem.                                                        8

   (*b*)   Define feasible solution and explain the standard form and its characteristics for general L.P.P.                                                          7

P.T.O.

2. Define basic feasible solution and explain the two-phase method for solution of linear programming problem. 15

*Or*

(a) If the feasible region of an L.P.P. is a convex polyhedron, then prove that there exists an optimal solution to an L.P.P. and at least one basic feasible solution must be optimal. 8

(b) Show that the following system of linear equations has a degenerate solution : 7

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

3. Attempt any *two* of the following : 5 each

(a) Discuss the Hungarian method of solving assignment problem.

(b) Explain the special cases in assignment problem

(c) A company wishes to assign 3 jobs to 3 machines in a such way that each job is assigned to some machine and no mechine works on more than one job. The cost matrix of assigning job $i$ to machine $j$ is given by the matrix below :

$$\text{Cost matrix :} \begin{bmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{bmatrix}$$

Formulate the network L.P.P. and find cost of making the assignment.

(d) The following is the cost matrix of assigning 4 clerks to 4 key punching jobs. Find the otpimal assignment if clerk 1 can not be assigned to job 1 :

| Clerk | Job | | | |
|-------|-----|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 | — | 5 | 2 | 0 |
| 2 | 4 | 7 | 5 | 6 |
| 3 | 5 | 8 | 4 | 3 |
| 4 | 3 | 6 | 6 | 2 |

What is the minimum total cost ?