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Y—94—2019

FACULTY OF SCIENCE

B.Sc. (Thrid Year) (Fifth Semester) (Backlog) EXAMINATION

OCTOBER/NOVEMBER, 2019

(CBCS Pattern)

MATHEMATICS

Paper XIV(A)

(Operation Research)

(Tuesday, 19-11-2019) **Time : 10.00 a.m. to 12.00 noon**

Time— Two Hours *Maximum Marks*—40

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

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

1. Attempt any *four* of the following : 2 each

(*a*) Define decision variables.

(*b*) What is unbounded solution ?

(*c*) Define Net Evaluation.

(*d*) Define Improved Basic feasible solution.

(*e*) What is an assignment problem ?

(*f*) What is prohibited assignments ?

2. Attempt any *two* of the following : 4 each

(*a*) Explain the iterative produce for mathematical formulation of a linear programming problem.

(*b*) Explain the three special cases that arise in the application of the graphical method.

(*c*) The manager of an oil refinery must decide on the optimum mix of two possible blending processes of which the input and output production runs are as follows :

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

P.T.O.

The maximum amount available of crude A and B are 250 units and 200 units respectively. Market demand shows that at least 150 units of Gasoline X and 130 units of Gasoline Y must be produced. The profit per production run ₹ 4 and ₹ 5 respectively. Formulate the problem for maximising the profit.

3. Attempt any *one* of the following : 8 each

(*a*) (*i*) Prove that, a basic feasible solution to an L.P.P. must correspond to an extreme point of the set of all feasible solutions.

(*ii*) Obtain all the basic solutions to the following system of linear equations :

$$x_1 + 2x_2 + x_3 = 4$$
$$2x_1 + x_2 + 5x_3 = 5$$

(*b*) (*i*) Explain the simplex algorithm for the solution of linear programming problem.

(*ii*) Solve the L.P.P. using two-phase simplex method :

Maximize : $z = 5x_1 + 3x_2$

Subject to the constraints :

$$2x_1 + x_2 \leq 1$$
$$x_1 + 4x_2 \geq 6$$
$$\text{and} \quad x_1, x_2 \geq 0.$$

4. Attempt any *two* of the following : 4 each

(*a*) Prove that, a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem is that :

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j = \lambda \text{ (say)}$$

(*b*) Explain Hungarian method for solving an assignment problem.

(*c*) A department head has four tasks to be performed and three subordinates, the subordinates differ in efficiency. The estimates of the time, each subordinate would take to perform, is given ahead in the matrix.

How should be allocate the tasks one to each man, so as to minimize the total man-hours ?

Task	Men		
	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

5. Attempt any *one* of the following : 8 each

(*a*) Define slack and surplus variables and explain the canoncial form of linear programming problem.

(*b*) Prove that, If an L.P.P. has a feasible solution, then it also has a basic feasible solution.

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

$$\text{Cost Matrix} = \begin{bmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{bmatrix}$$

Then draw the associated network, formulate the network LPP and find the minimum cost of making the assignment.