Total No. of Sections : 4

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III Semester Examination, 2021

M.Sc.

MATHEMATICS

Paper IV

[Operations Research]

Time : Three Hours] [Maximum Marks : 80

[Minimum Passing Marks : 16

Note : Part A and B of each question in each unit consist of very short answer type questions which are to be answered in one or two sentences. Part C (Short answer type) of each question will be answered 200-250 words. Part D (Long answer type) of each question should be answered within the word limit 400-450.

Unit–I

1. (A) Write any two limitations of O.R. **2**

(B) Define unbounded solution in L.P.P. **2**

(C) Reduce the following L.P.P. to its standard form : **4**

Maximize, $z = x_1 - 3x_2$

P. T. O.

Subject to constraints,

$$- x_1 + 2x_2 \leq 15$$

$$x_1 + 3x_2 = 10$$

x_1 and x_2 unrestricted in sign.

Or

Write steps which are involved in solving a L.P.P. using Big M method.

(D) Solve by Simplex method : **12**

Maximize, $z = 5x_1 + 3x_2$

Subject to constraints,

$$x_1 + x_2 \leq 2$$

$$5x_1 + 2x_2 \leq 10$$

$$3x_1 + 8x_2 \leq 12$$

$$x_1, x_2 \geq 0$$

Or

Solve the following L.P.P. by using the two phase method :

Minimize, $z = x_1 + x_2$

Subject to constraints,

[2]

(B) Write two applications of the maximal flow problems. **2**

(C) Explain float of an activity and event. **4**

Or

Write distinction between PERT and CPM.

(D) For the network shown below, use the augmenting path algorithm to find the flow pattern giving the maximum flow from the source to the sink, given that the link capacity from node i to node j is the number nearest node i along the link between these nodes. **12**

Node O represents the source and node S is the sink :
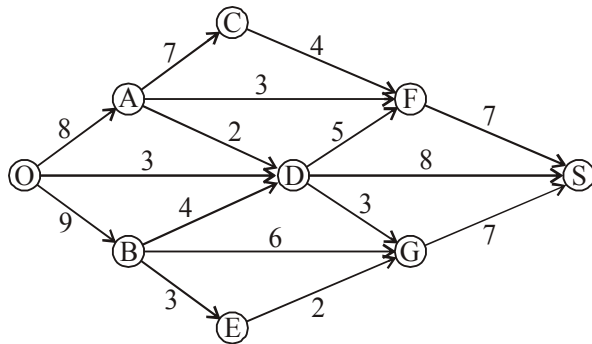
Or

The following are the details of estimated times of activities of a certain project :

Activity	Immediate predecessors	Normal time (days)
A	—	16
B	—	20
C	A	8
D	A	10
E	B, C	6
F	D, E	12

(a) Find the critical path and the expected time of the project.

(b) Find the total and free float for each activity.

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$$2x_1 + x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7$$

$$x_1, x_2 \geq 0.$$

Unit–II

2. (A) Write any two applications of duality.   **2**

(B) State strong duality theorem.   **2**

(C) Write the dual of the following L.P.P. :   **4**

Minimize, $z = 5x_1 - 6x_2 + 4x_3$

Subject to constraints,

$$3x_1 + 4x_2 + 6x_3 \geq 9$$

$$x_1 + 2x_2 + 2x_3 \geq 8$$

$$7x_1 - 2x_2 - x_3 \leq 12$$

$$x_1 - 2x_2 + 4x_3 \geq 6$$

$$2x_1 + 5x_2 - 3x_3 = 8$$

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

Or

State and prove weak duality theorem.

(D) Use dual Simplex method to solve the L.P.P. :

     12

Maximize, $z = -3x_1 - 2x_2$

Subject to constraints,

$$x_1 + x_2 \geq 1$$

$$x_1 + x_2 \leq 7$$

$$x_1 + 2x_2 \geq 10$$

$$x_2 \leq 3$$

and $x_1, x_2 \geq 0.$

Or

For the following L.P.P. :

Maximize, $z = (3 - 6\lambda) x_1 + (2 - 2\lambda) x_2$

$$+ (5 + 5\lambda) x_3$$

Subject to constraints,

$$x_1 + 2x_2 + x_3 \leq 430$$

$$3x_1 + 2x_3 \leq 460$$

$$x_1 + 4x_2 \leq 420$$

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

Find the range of λ over which the solution remains basic feasible and optimal.

Unit–III

3. (A) What is a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem ? **2**

(B) Write the name of any two methods to solve a assignment problem. **2**

(C) Explain the travelling salesman problem. **4**

Or

How the problem of degeneracy arises in a transportation problem ? Explain how does one overcome it ?

(D) Four gasoline dealers A, B, C and D require 50, 40, 60 and 40 KL of gasoline respectively. It is possible to supply these from locations 1, 2 and 3 which have 80, 100 and 50 KL respectively. The cost (in ₹) for shipping every KL is shown in the following table : **12**

[5]   P. T. O.

		A	B	C	D
	1	7	6	6	6
Location	2	5	7	6	7
	3	8	5	8	6

Determine the most economical supply pattern.

Or

The following is the cost matrix of assigning 4 clecks to 4 key punching jobs.

Find the optimal assignment if clerk 1 cannot be assigned to job 1 :

	Job			
Clerk	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 ?

Unit–IV

4. (A) Give any one characteristics of minimal spanning tree problem. **2**

[6]