IFoS LPP

2020

1. 1d 2020 IFoS

Solve graphically the following LPP :

$$\text{Max} \quad z = 5x_1 - 3x_2$$

subject to

$$3x_1 + 2x_2 \le 12$$
$$-x_1 + x_2 \ge 1$$
$$-x_1 + x_2 \le 2$$
$$x_1, x_2 \ge 0$$

If the objective function z is changed to Max $z = 6x_1 + 4x_2$, while the constraints remain the same, then comment on the number of solutions. Will (4, 0) be also a solution? 8

2. 3c 2020 IFoS

Solve the following LPP by simplex method :

$$\text{Max} \quad z = 2x_1 + x_2$$

subject to

$$2x_1 - 2x_2 \le 1$$
$$2x_1 - 4x_2 \le 3$$
$$2x_1 + x_2 \le 2$$
$$x_1, x_2 \ge 0$$

Does there exist an alternate optimal solution? If yes, give one and hence find all the optimal solutions. 15

3. 4c 2020 IFoS

Find the minimum transportation cost using Vogel's approximation method for the following transportation problem :

Destinations

		D_1	D_2	D_3	D_4	*Availability*
	S_1	9	16	15	9	15
Sources	S_2	2	1	3	5	25
	S_3	6	4	7	3	20
Demand		10	15	25	10	

15

2019

1. 1e 2019 IFoS

A firm manufactures two products A and B on which the profits earned per unit are ₹ 3 and ₹ 4 respectively. Each product is processed on two machines M1 and M2. Product A requires one minute of processing time on M1 and two minutes on M2, while B requires one minute on M1 and one minute on M2. Machine M1 is available for not more than 7 hours 30 minutes, while machine M2 is available for 10 hours during any working day. Find the number of units of products A and B to be manufactured to get maximum profit, using graphical method. *8*

2. 3c 2019 IFoS

Use simplex method to solve the following problem : *15*

Maximize $z = 2x_1 + 5x_2$

subject to $x_1 + 4x_2 \leq 24$

$$3x_1 + x_2 \leq 21$$

$$x_1 + x_2 \leq 9$$

$$x_1, x_2 \geq 0$$

3. 4c 2019 IFoS

A salesman wants to visit cities C1, C2, C3 and C4. He does not want to visit any city twice before completing the tour of all the cities and wishes to return to his home city, the starting station. Cost of going from one city to another in rupees is given below in the table. Find the least cost route. *15*

From City \ To City	C1	C2	C3	C4
C1	0	30	80	50
C2	40	0	140	30
C3	40	50	0	20
C4	70	80	130	0

2018

1. 1d

Solve by simplex method the following Linear Programming Problem : 12

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

subject to the constraints

$$x_1 + 2x_2 + x_3 \leq 430$$
$$3x_1 + 2x_3 \leq 460$$
$$x_1 + 4x_2 \leq 420$$
$$x_1,\ x_2,\ x_3 \geq 0$$

2. 4d

The capacities of three production facilities S_1, S_2 and S_3 and the requirements of four destinations D_1, D_2, D_3 and D_4 and transportation costs in rupees are given in the following table :

	D_1	D_2	D_3	D_4	*Capacity*
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

Find the minimum transportation cost using Vogel's Approximation Method (VAM). 12

2017

1. 1d

Solve by simplex method the following LPP :

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

subject to the constraints

$3x_1 - x_2 + 2x_3 \leq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 0$

and $x_1, x_2, x_3 \geq 0$ 14

2. 4d

A computer centre has four expert programmers. The centre needs four application programs to be developed. The head of the centre after studying carefully the programs to be developed, estimates the computer times in hours required by the experts to the application programs as follows :

Programs

Programmer	A	B	C	D
P_1	5	3	2	8
P_2	7	9	2	6
P_3	6	4	5	7
P_4	5	7	7	8

Assign the programs to the programmers in such a way that total computer time is least. 12

2016

1. 1e

Prove that the set of all feasible solutions of a Linear Programming problem is a convex set. 8

2. 4d

A company manufacturing air-coolers has two plants located at Bengaluru and Mumbai with a weekly capacity of 200 units and 100 units respectively. The company supplies air-coolers to its 4 showrooms situated at Mangalore, Bengaluru, Delhi and Goa which have a demand of 75, 100, 100 and 25 units respectively. Due to the differences in local taxes, showroom charges, transportation cost and others, the profits differ. The profits (in Rs.) are shown in the following table :

From	To			
	Mangalore	Bengaluru	Delhi	Goa
Bengaluru	90	90	100	100
Mumbai	50	70	130	85

Plan the production program so as to maximize the profit. The company may have its production capacity at both plants partially or wholly unused. 12

2015

1. 1d

Solve graphically :

Maximize $z = 7x + 4y$

subject to $2x + y \leq 2$, $x + 10y \leq 10$ and $x \leq 8$.

(Draw your own graph without graph paper). *10*

2. 3c

A manufacturer wants to maximise his daily output of bulbs which are made by two processes P_1 and P_2. If x_1 is the output by process P_1 and x_2 is the output by process P_2, then the total labour hours is given by $2x_1 + 3x_2$ and this cannot exceed 130, the total machine time is given by $3x_1 + 8x_2$ which cannot exceed 300 and the total raw material is given by $4x_1 + 2x_2$ and this cannot exceed 140. What should x_1 and x_2 be so that the total output $x_1 + x_2$ is maximum ? Solve by the simplex method only. *14*

3. 4c

Solve the following transportation problem : *10*

	D_1	D_2	D_3	Supply
O_1	5	3	6	20
O_2	4	7	9	40
Demand	15	22	23	60

2014

1. 1d

Obtain the initial basic feasible solution for the transportation problem by North-West corner rule : 8

		Retail Shop					
		R_1	R_2	R_3	R_4	R_5	*Supply*
	F_1	1	9	13	36	51	50
Factory	F_2	24	12	16	20	1	100
	F_3	14	35	1	23	26	150
		100	70	50	40	40	

2. 4c

Solve the following LPP graphically :

$$\begin{aligned} \text{Maximize} \quad & Z = 3x_1 + 4x_2 \\ \text{subject to} \quad & x_1 + x_2 \le 6 \\ & x_1 - x_2 \le 2 \\ & x_2 \le 4 \\ & x_1,\ x_2 \ge 0 \end{aligned}$$

Write the dual problem of the above and obtain the optimal value of the objective function of the dual without actually solving it. 15

2013

1. 1d

Find the optimal assignment cost from the following cost matrix : *10*

	A	B	C	D
I	4	5	4	3
II	3	2	2	6
III	4	5	3	5
IV	2	4	2	6

2. 2c

Solve the following Salesman problem : *14*

	A	B	C	D
A	∞	12	10	15
B	16	∞	11	13
C	17	18	∞	20
D	13	11	18	∞

3. 4c

$x_1 = 4,\ x_2 = 1,\ x_3 = 3$ is a feasible solution of the system of equations

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

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

Reduce the feasible solution to two different basic feasible solutions. *14*

2012

1. 2c

Solve the following problem by Simplex Method. How does the optimal table indicate that the optimal solution obtained is not unique ?

Maximize $z = 8x_1 + 7x_2 - 2x_3$

subject to the constraints

$$x_1 + 2x_2 + 2x_3 \leq 12$$
$$2x_1 + x_2 - 2x_3 \leq 12$$
$$x_1, x_2, x_3 \geq 0$$

14

2. 4c

(c) Find the initial basic feasible solution of the following minimum cost transportation problem by Least Cost (Matrix Minima) Method and using it find the *optimal* transportation cost :—

Destinations

		D_1	D_2	D_3	D_4	Supply
	S_1	5	11	12	13	10
Sources	S_2	8	12	7	8	30
	S_3	12	7	15	6	35
Requirement		15	15	20	25	

14

2011

1. 1e

Write the dual of the linear programming problem (LPP) :

$$\text{Minimize } Z = 18x_1 + 9x_2 + 10x_3$$

subject to

$$x_1 + x_2 + 2x_3 \geq 30$$
$$2x_1 + x_2 \geq 15$$
$$x_1, x_2, x_3 \geq 0$$

Solve the dual graphically. Hence obtain the minimum objective function value of the above LPP. 10

2. 3c

Reduce the feasible solution $x_1 = 2$, $x_2 = 1$, $x_3 = 1$ for the linear programming problem

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

subject to

$$x_1 - x_2 + 3x_3 = 4$$
$$2x_1 + x_2 + x_3 = 6$$
$$x_1, x_2, x_3 \geq 0$$

to a basic feasible solution. 14

3. 4c

(c) A steel company has three open-hearth furnaces and four rolling mills. Transportation costs (rupees per quintal) for shipping steel from furnaces to rolling mills are given in the following table :

	M_1	M_2	M_3	M_4	*Supply* (quintals)
F_1	29	40	60	20	7
F_2	80	40	50	70	10
F_3	50	18	80	30	18
Demand (quintals)	4	8	8	15	

Find the optimal shipping schedule. 14

2010

1. 1e

A captain of a cricket team has to allot four middle-order batting positions to four batsmen. The average number of runs scored by each batsman at these positions are as follows. Assign each batsman his batting position for *maximum* performance : 10

Batsman \ Batting position	IV	V	VI	VII
A	40	25	20	35
B	36	30	24	40
C	38	30	18	40
D	40	23	15	33

2. 3c

Solve the following linear programming problem by the simplex method : 14

Maximize $Z = 3x_1 + 4x_2 + x_3$

subject to

$$x_1 + 2x_2 + 7x_3 \leq 8$$
$$x_1 + x_2 - 2x_3 \leq 6$$
$$x_1,\ x_2, x_3 \geq 0$$

3. 4c

ABC Electricals manufactures and sells two models of lamps, L_1 and L_2, the profit per unit being Rs 50 and Rs 30, respectively. The process involves two workers W_1 and W_2, who are available for 40 hours and 30 hours per week, respectively. W_1 assembles each unit of L_1 in 30 minutes and that of L_2 in 40 minutes. W_2 paints each unit of L_1 in 30 minutes and that of L_2 in 15 minutes. Assuming that all lamps made can be sold, determine the weekly production figures that maximize the profit. 14