JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-V Semester (CE)

COURSE CODE (CREDITS): 20B1WCE531 (3) MAX. MARKS: 35

COURSE NAME: MODELLING, SIMULATION AND COMPUTER APPLICATION

COURSE INSTRUCTORS: Dr. Tanmay Gupta MAX. TIME: 2 Hours

Note: (a)All questions are compulsory.

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

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Q.1 A company produces a single product and selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in five more cities that do not have any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to additional cities in such a way that the travelling distance is minimized. The distances (in km) between the surplus and deficit cities are given in the following distance matrix. **[8][CO3]**

Surplus City \ Deficit city	I	II	III	IV	V
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

Q.2 A company has three plants 1, 2, 3, from which it supplies to 4 markets 1, 2, 3. Determine the optimal transportation plan from the following data giving the plant to market shifting cost, quantities available at each plant and quantities required at each market. **[8][CO3]**

MARKET	PLANT			REQUIRED
	1	2	3	
1	2	7	4	5
2	3	3	1	8
3	5	4	7	7
4	1	6	2	14
AVAILABLE	7	9	18	34

Q.3 A factory can produce four products denoted by P1, P2, P3 and P4. Each product must be processed in each of two workshops. The processing times (in hours per unit produced) are given in the following table. 400 hours of labour are available in each workshop. The profit margins

are 4, 6, 10, and 9 dollars per unit of P1, P2, P3 and P4 produced, respectively. Everything that is produced can be sold. Thus, maximizing profits, answer the following questions after setting up linear program. **[7][CO2]**

	P_1	P_2	P_3	P_4
Workshop 1	3	4	8	6
Workshop 2	6	2	5	8

Introducing slack variables s1 and s2 in Rows 1 and 2, respectively, and applying the simplex method, we get the final tableau:

z	x_1	x_2	x_3	x_4	s_1	s_2	RHS
1	0.5	0	2	0	1.5	0	600
0	0.75	1	2	1.5	0.25	0	100
0	4.5	0	1	5	−0.5	1	200

(a) How many units of P1, P2, P3 and P4 should be produced in order to maximize profitts?
(b) Assume that 20 units of P3 have been produced by mistake. What is the resulting decrease in profit?
(c) In what range can the profit margin per unit of P1 vary without changing the optimal basis?
(d) In what range can the profit margin per unit of P2 vary without changing the optimal basis?
(e) What is the marginal value of increasing the production capacity of Workshop 1?
(f) In what range can the capacity of Workshop 1 vary without changing the optimal basis?
(g) Management is considering the production of a new product P5 that would require 2 hours in Workshop 1 and ten hours in Workshop 2. What is the minimum profit margin needed on this new product to make it worth producing?

Q.4 For the following LPP
Minimize $Z = 3x_1 + 2x_2$
Subjected to
$3x_1 + x_2 \leq 12$
$x_1 + x_2 \leq 6$
$5x_1 + 3x_2 \leq 27$
$x_1, x_2 \geq 0$
Write the dual of the above problem, Solve the problem by Regular Simplex method, Solve the dual by the dual Simplex method. **[6][CO2]**

Q.5 Write a short note on following **[6][CO1,2]**
(A) Disadvantages of performing modelling and simulation.
(B) Generalized simplex algorithm.
(C) Classification of optimization problems based on nature of variables involved.