School of Mathematics, TIET, PATIALA

Auxiliary Examination, August 18, 2022

B.E.(Sem IV&VI)

Course Name: Optimization Techniques **Course Code:** (UMA035/UMA031)

TIME: 2 Hours. MAXIMUM MARKS : 50

Faculty: MKS,AK,MKR,SJK,NK,PN,MG,JPR,BHU,SPNP,TV

NOTE: ALL QUESTIONS ARE COMPULSORY

1(a). The material science division needs circular metallic plates of diameters 3cm and 6 cm to perform experiments on heat treatment studies, and requirement of these plates are 2500 and 1500 respectively. These are to be cut from parent metallic sheets of dimension 6x15 cm. Formulate the problem as a linear programming problem so that the minimum numbers of parent metallic sheets are used. 5

(b) Find the optimal solution of the following linear programming problem by using the graphical method 5

$$\textit{Maximize} \quad z = 5x_1 + 4x_2$$

$$\textit{subject to} \quad 6x_1 + 4x_2 \le 24;\ x_1 + 2x_2 \le 6;\ -x_1 + x_2 \le 1;\ x_2 \le 2;\ x_1, x_2 \ge 0$$

2(a). Solve the following LPP by a dual simplex method. 4

$$\textit{Max} \quad z = -2x_1 - 3x_2$$

$$\textit{Subject to} \quad -2x_1 + x_2 \ge 3\ ;\ 3x_1 + x_2 \le 5;\ \ x_1, x_2 \ge 0$$

(b). Using Simplex methods find the optimal solution of the following

$$\textit{Maximize} \quad z = 10x_1 + 15x_2 + 20x_3$$

$$\textit{subject to} \quad 2x_1 + 4x_2 + 6x_3 \le 24;\ \ 3x_1 + 9x_2 + 6x_3 \le 30;\ \ x_1, x_2, x_3 \ge 0$$

Is the optimal solution unique? If not, find all the alternate optimal solutions (BFS only). 6

3. A transport company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and the demand (also in truckloads) together with the unit transportation cost (in Rs) per truckload on the different routs are summarized in the transportation model in following table

		Mill				Supply
		1	2	3	4	
Silo	1	10	2	20	11	15
	2	12	7	9	20	25
	3	4	14	16	18	10
Demand		5	15	15	15	

Find optimal cost shipping between silos and the mills by using u-v method. (Use Least Cost Method for initial basic feasible solution) 10

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4(a). Consider the data of a project as shown in Table.

Activity	Normal time (in weeks)	Normal cost (in Rs.)	Crash time (in weeks)	Crash cost(in Rs.)
1-2	13	700	9	900
1-3	5	400	4	460
1-4	7	600	4	810
2-5	12	800	11	865
3-2	6	900	4	1130
3-4	5	1000	3	1180
4-5	9	1500	6	1800

(i) Draw a network diagram for this project and find the critical path and normal duration of the project completion.

(ii) Find the most economical schedule if the project is to be completed in 23 days. 7

(b) With suitable example Define efficient solutions and efficient frontier for a multiobjective optimization problem. 3

5(a). Solve the following nonlinear program by Lagrange's multiplier method.

$Max\ f(x) = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$ s/t $x_1 + x_2 + x_3 = 15$ $2x_1 - x_2 + 2x_3 = 20$, $x_1, x_2, x_3 \geq 0$ 6

(b) Solve the following Integer LPP using Branch and Bound technique.

$Min\ z = 5x_1 + 4x_2$

Subject to $3x_1 + 2x_2 \geq 5$; $2x_1 + 3x_2 \geq 7; x_1, x_2 \geq 0$ *and integers.* 4