Extra CO2

Roll Number:

School of Mathematics, TIET, PATIALA
End Semester Examination, December 12, 2022

B.E(Sem III)
Course Name: Optimization Techniques | **Course Code:** (UMA035/UMA031)
TIME: 3 Hours. | MAXIMUM MARKS : 40
Faculty: MKS
NOTE: ALL QUESTIONS ARE COMPULSORY

Q1(a). Find all the basic solutions (use algebraic method) and identify the basic feasible solutions of the following linear programming problem (LPP)
$Max\ z = 20x_1 + 25x_2$, subject to $20x_1 + 10x_2 \le 100$, $20x_1 + 15x_2 \le 120$, $x_1, x_2 \ge 0$. 3

(b) Consider the problem $Min\ z = x_1 - 2x_2 + x_3$ subject to $x_1 + 2x_2 - 2x_3 \le 4$ $x_1 - x_3 \le 3$, $2x_1 - x_2 + 2x_3 \le 2$, $x_1, x_2, x_3 \ge 0$. The one of the simplex table of the above LPP is:

BV	x_1	x_2	x_3	s_1	s_2	s_3	Solution
$z_j - c_j$	*	*	*	*	*	*	*
x_2	*	*	*	1	*	1	*
s_2	*	*	*	1/2	*	1	*
x_3	*	*	*	1/2	*	1	*

Without performing simplex iterations, find all missing entries in the above table. Justify your answer by writing the formula used and doing all calculations. 4

Q2(a). Let following be the simplex table of a LPP (maximization problem) at some iteration

BV	x_1	x_2	s_1	s_2	Solution
$z_j - c_j$	0	d	0	e	
s_1	0	c	1	1	a
x_1	1	-1	0	2	b

State all possible values of a, b, c, d and e in each of the following so that the given statement is true

(i) the current solution is optimal (ii) the given LPP has unbounded solution

(ii) the current solution is optimal but the LPP has many optimal solution 3

(b) Use dual simplex method to find the optimal solution of following LPP.
$Min\ z = 5x_1 + 6x_2$ subject to $x_1 + 2x_2 \ge 2$, $4x_1 + x_2 \ge 4$, , $x_1, x_2 \ge 0$. 3

Q3. Using Branch and bound method, to find the optimal solution of the following Integer LPP
$Max\ z = x_1 + x_2$, subject to $2x_1 + 5x_2 \le 16$, $6x_1 + 5x_2 \le 30$, $x_1, x_2 \ge 0$ and integers. 3

Q4(a). In an unbalanced transportation problem (TP), some times there are penalties for unsatisfied demand, to reflect the failure the problem of the supplier to meet the required demand. Consider the problem

		D_1	D_2	D_3	Supply
	S_1	1	5	6	90
	S_2	3	2	3	10
	S_3	2	6	1	20
Demand		60	50	50	

Let the penalty cost per unit of unsatisfied demand be 6, 4 and 2 for destinations D_1, D_2 and D_3 respectively. Find an optimal solution (use north west corner rule for initial basic feasible solution)of the given TP. Also identify the destination which will have short supply and by how many units. 5

PTO

(b) A company has five machines and five jobs to be completed. Each machine must be assigned to complete one job. The time required to set up each machine for completing the job is shown in the following table. Company wants to minimized the total setup time needed to complete the five jobs.

	Time (Hours)				
Machine	Job 1	Job 2	Job 3	Job 4	Job 5
M_1	10	12	15	12	8
M_2	7	16	14	14	11
M_3	13	14	7	9	9
M_4	12	10	11	13	10
M_5	6	13	15	11	15

Use Hungarian method to find the optimal solution of this problem. 3

Q5. Consider the data of a project as shown in following table.

Activity	Duration (in months)		Direct Cost(in thosand)	
	Normal	Crash	Normal	Crash
1-2	4	3	60	90
1-4	6	4	150	250
1-3	2	1	40	60
2-4	5	4	150	250
3-4	2	2	100	200
2-5	9	7	200	400
4-5	4	3	100	240

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

(ii) Find the associated minimum cost if the project is to be completed in 12 months.

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Q6(a). State Kuhn – Tucker necessary and sufficient conditions and consider the following nonlinear programming problem (NLPP)

$Min\, z = 2x_1^2 + 2x_2^2 + 2x_1x_2 - 4x_1 - 6x_2 - 49$, subject to $x_1 + x_2 - 2 \leq 0,\ x_1, x_2 \geq 0$. Show that this program is a convex NLPP and find the optimum solution of this NLPP by using KT conditions. 5

(b) Use Fibonacci method to minimize the function $Min z = 2x - x^2, 0 \leq x \leq 1.5$, within the interval of uncertainty $0.25L_0$, where L_0 is the length of initial interval of uncertainty. 3

Q7. Explain efficient solutions and efficient frontier for multiobjective linear programming problem with the help of example. 3