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Thapar University, Patiala

School of Mathematics

END SEMESTER EXAMINATION

B. E. (Second Year): Semester-I (2016/17)
(ME/MTX/CIE/CHE/ELE/MPE/EIC)

Course Code: UMA031
Course Name: Optimization
Techniques

December 13, 2016

Time: 3 Hours, M. Marks: 100

Name Of Faculty: MKS, AK, MKR, VKS,
NK, JPR, RN

Note: Attempt all questions. The evaluated answer sheets can be seen on Dec 21, 2016 in G-303 at 11:30 am.

- Q.1 Use the Simplex method to solve
 $\text{Max } z = 5x_1 + 4x_2$ s.t. $6x_1 + 4x_2 \leq 24$, $x_1 + 2x_2 \leq 6$, $-x_1 + x_2 \leq 1$, $x_2 \leq 2$, $x_1, x_2 \geq 0$,
Plot the feasible region using x_1 and x_2 as coordinates. Follow the solution steps of the simplex method graphically by interpreting the shift from one basic feasible solution to the next in the feasible region. (12)
- Q.2 Use branch and bound method to solve the following integer linear programming problem. (12)
 $\text{Max } z = 3x_1 + 4x_2$ s.t. $7x_1 + 16x_2 \leq 52$, $x_2 \geq 2$, $x_1, x_2 \geq 0$ and integers.
- Q.3 Three electronic power plants, namely S_1 , S_2 and S_3 with capacities 20, 40 and 30 million kwh supply electricity to three cities D_1 , D_2 and D_3 . The maximum demands at three cities are estimated as 30, 20 and 20 million kwh. The price per million kwh at three cities (in dollars) is given below: (20)

	D_1	D_2	D_3
S_1	1	2	1
S_2	0	4	5
S_3	2	3	2

If a unit from electric plant is not shipped out, a storage cost is incurred at the rate of \$3, \$4 and \$5 per unit for S_1 , S_2 and S_3 respectively. The utility company wishes to determine the most economical plant for the distribution and purchase of energy.

- (a) Use Vogel's approximation method to find starting basic feasible solution.
(b) Determine an optimal distribution plan for the utility company.
(c) Determine an alternative optimal distribution plan for the company, if exists.
- Q.4 A captain of a cricket team has to allot four middle batting positions. The average runs scored by each batsman at these positions are given in the table.
Find the arrangement of batsmen to positions which would give the maximum number of runs.

	P	Q	R	S
I	42	35	28	21
II	30	25	20	15
III	30	25	20	15
IV	24	20	16	12

(16)

- Q.5 A company is in the process of preparing a budget for launching a new product. The following table provides the associated activities. Construct the project network.

(5)

	Activity	Predecessor(s)
A	Forecast sales volume	-----
B	Study competitive market	-----
C	Design item and facilities	A
D	Prepare production schedule	C
E	Estimate cost of production	D
F	Set sales price	B, E
G	Prepare budget	E, F

- Q.6 A small project consists of the following activities where duration is in days and cost is in rupees are given in the following table.

(20)

Activity	Duration	Normal duration	Normal cost	Crash duration	Crash cost
(1-2)	5	5	3000	4	4000
(2-3)	6	6	1200	2	2000
(2-5)	4	4	1000	3	1800
(2-4)	5	5	1200	3	2000
(3-5)	0	0	0	0	0
(4-5)	0	0	0	0	0
(5-6)	3	3	1600	3	1600

- (a) Use critical path method to find the normal duration for completing the project.

- (b) Find the most economical schedule for completing the project in 12 days.

- Q.7 The payoff matrix of Player A is shown in below Table.

(15)

	Player B			
	3	8	4	4
Player A	-7	2	10	2

- (a) Find the optimal solution using graphical method.
 (b) Write the linear programming problem with respect to Player A.
 (c) Write the linear programming problem with respect to Player B.