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Thapar University, Patiala

School of Mathematics

END SEMESTER EXAMINATION

B. E. (Second Year): Semester-II (2016/17) (COE/CML/CAG/SEM/ECE/ENC)	Course Code: UMA031 Course Name: Optimization Techniques
May 11, 2017	Thursday
Time: 3 Hours, M. Marks: 100	Name Of Faculty: MKS, AK, MKR, SJK, VKS, NK, RN, ID

Note: Attempt all questions.

Q.1	Consider the problem Min $z = 2x_1 + x_2$ s/t $3x_1 + x_2 \geq 3,\ 4x_1 + 3x_2 \geq 6,\ x_1 + 2x_2 \leq 3,\ x_1, x_2 \geq 0.$ (a) Using dual simplex method find the optimal solution of the above LPP (b) Trace the path of dual simplex iterations on graphical solution space for the given LPP. (c) Is the optimal solution, obtained in part (a), degenerate?	(14)
Q.2	A company manufactures two products A and B. The unit revenues are \$30 and \$20 respectively. Two raw materials M_1 and M_2, used in the manufacture of these products, have daily availabilities for each 16 units. To make one unit of A, 4 unit of M_1 as well as 2 units of M_2 and to make one unit of B, 2 unit of M_1 as well as 6 units of M_2 is required. Assuming x_1 and x_2 as the number of units of products A and B that should be made daily to maximize the total revenue, can be mathematically formulated into following LPP. Max $z = 30x_1 + 20x_2$ s/t $4x_1 + 2x_2 \leq 16,\ 2x_1 + 6x_2 \leq 16,\ x_1, x_2 \geq 0.$ If the availability of M_1 is increased by 2 units (from 16 to 18 units). Then, using graphical sensitivity analysis, find the following: (i) Dual price of M_1. (ii) Feasibility range of M_1 (iii) Optimality range for unit revenue of product A.	(10)
Q.3	Allahabad, Bombay, Calcutta and Delhi are four distribution centers with identical cost of production at the three factories, the only variable cost involved is transportation cost. The production at the three factories is 5000 tonnes, 6000 tonnes and 2500 tonnes respectively. The demand at four distribution centres is 6000 tonnes, 4000 tonnes, 2000 tonnes and 1500 tonnes respectively. The transportation cost per tonne from different factories to different centres are given below:	(20)

	D_1	D_2	D_3	D_4
F_1	3	1	7	6
F_2	7	4	0	8
F_3	2	5	4	5

(a) Use Least cost method to find starting basic feasible solution.
(b) Determine an optimal distribution plan for the given transportation problem.

Q.4 A city corporation has decided to carry out road repairs on main four arteries of the city. The government has agreed to make special grant of Rs. 50 lacs towards the cost with a condition that the repair must be done at the lowest cost and quickest time. If conditions warrant, then a supplementary token grant will also be considered favorably. The corporation has floated tenders and five contractors have sent in their bids. In order to expedite work, one road will be awarded to only one contractor. (10)

	R_1	R_2	R_3	R_4
C_1	9	14	19	15
C_2	7	17	20	19
C_3	9	18	21	18
C_4	10	12	18	19
C_5	10	15	21	16

(a) Find the best way of assigning the repair work to the contractors.
(b) If it is necessary to seek supplementary grants, then what should be the amount sought?
(c) Which of the five contractors will be unsuccessful in his bid.

Q.5 Use branch and bound method to solve the following integer linear programming problem. (10)

Min $z = 4x_1 + 3x_2$ s/t $5x_1 + 3x_2 \geq 30$, $x_1 \leq 4, x_2 \leq 6$, $x_1, x_2 \geq 0$ and integers.

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. (16)

Activity	Description	Normal duration	Normal cost	Crash duration	Crash cost
(1-2)	Market Research	6	600	4	1000
(1-3)	Make drawings	4	600	2	2000
(2-4)	Decide Production Policy	5	500	3	1500
(2-5)	Prepare Sales Programme	3	450	1	650
(3-4)	Prepare Operation Sheets	6	900	4	2000
(4-6)	Buy Materials	8	800	4	3000
(5-6)	Plan labour force	4	400	2	1000
(6-7)	Produce Product	3	450	2	800

The indirect cost per day is Rs. 100.

(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 20 days including indirect cost.

Q.7 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	Immediate Predecessor(s)
A	Forecast sales volume	----------
B	Study competitive market	----------
C	Design item and facilities	----------
D	Prepare production schedule	*B* , *C*
E	Estimate cost of production	*A*
F	Set sales price	*A* , *B*
G	Prepare budget	*D*
H	Audit	*E* , *F*

Q.8 The payoff matrix of Player A is shown in below Table. (15)

	Player B			
Player A	2	1	0	− 2
	1	0	3	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.