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End Semester Examination of Semester–III, 2015
Subject : MATHEMATICS (PG)
Paper : MTM–305 (IB) (Theory)
Full Marks : 40
Time : 2 Hrs

The figures in the margin indicate the marks corresponding to the question.

Candidates are requested to give their answers in their own word as far as practicable.

Illustrate the answers wherever necessary

Group A

Answer **any two** out of four questions : 10x2=20

1. A small furnishing company manufactures tables and chairs. Each chair requires 4 man-hour of labour while each table requires 5 man-hour of labour. If only 80 man-hours are available each week and the owner of the company would neither hire additional labour nor utilize overtime, formulate the linear goal programming problem and solve it by Graphical method. Both the table and the chair fetch a profit of Rs 100 each. The owner has a target to earn a profit of Rs 2,000 per week. Also he would like to supply 10 chairs, if possible, per week to a sister concerns. 10

2. a) Use modified dual simplex method to solve the LPP

$\text{Max } Z = 2x_1 - 3x_2 - 2x_3$

Subject to $x_1 - 2x_2 - 3x_3 = 8$

$2x_2 + x_3 \leq 10$

$x_2 - 2x_3 \geq 4, \; x_1, x_2, x_3 \geq 0.$ 5

b) Use Kuhn-Tucker Conditions to solve the NLP problem

$\text{Max } Z = 2x_1 - x_1^2 + x_2$

Subject to $2x_1 + 3x_2 \leq 6$

$2x_1 + 4x_2 \leq 4$

$x_1, x_2 \geq 0.$ 5

3. a) If a quadratic function $Q(X) = \frac{1}{2} X^T A X + B^T X + C$ is minimized sequentially along each direction of a set of a n A-conjugate directions, then the global minimum of Q(x) will be located at before the nth step regardless of the starting point and the order in which directions are used. Where A is a nxn real symmetric matrix.
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b) Find the conjugate directions of the following real symmetric matrix $\begin{pmatrix} 1 & 2 \\ 2 & -3 \end{pmatrix}$. 2

4. Formulate the Gomory's constraint for a general IP problem. Use the Gomory's cutting plane method to solve the following IPP

Maximize $Z = x_1 + x_2$

Subject to $3x_1 + 2x_2 \leq 12$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ and integers. 3+7

Group B

Answer **any two** out of four questions : 6x2=12

5. Consider the LPP

Max $z = 5x_1 + 12x_2 + 4x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 5$

$2x_1 - x_2 + 3x_3 = 2$

$x_1, x_2, x_3 \geq 0$

Determine the range for the discrete change of the requirement vectors on the optimality of the optimum basic feasible solution.

6. Let us consider the final table of a LPP

		C_j	2	4	1	3	2	0	0	0
C_B	y_B	x_B	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8
2	y_1	3	1	0	0	–1	0	0·5	0·2	–1
4	y_2	1	0	1	0	2	1	–1	0	0·5
1	y_3	7	0	0	1	–1	–2	5	–0·3	2
	$z_j - c_j$		0	0	0	2	0	2	0·1	2

Where y_6, y_7, y_8 are the stock variables if the constraints.

i) $2x_1 + 3x_2 - x_3 + 2x_4 + 4x_5 \leq 5$ or

ii) $2x_1 + 3x_2 - x_3 + 2x_4 + 4x_5 \leq 1$ added, then find the solution of the changed LPP.

7. Minimize $f(x) = \frac{1}{4}(x^2 - 6x + 13), x \leq 4$

$= x - 2, x > 4$

in the interval (2, 5) by Fibonacci method taking $n = 6$.

8. Use golden section method to minimize the following function f(x) in the interval [2, 8] upto five experiments,

Where $f(x) = \begin{cases} 6 - x, & x \leq 5 \\ 2x - 9, & x > 5. \end{cases}$

Group C

Answer any **four** out of eight questions : 2x4=8

9. What is unimodal function?

10. Test the function $f(x) = x_1^2 + 3x_1x_2 + 2x_2^2$ whether it is convex, concave or neither.

11. Find the saddle point to the function $f(x_1, x_2) = 18x_1x_2 + 5x_2^2$.

12. Explain the significance of inflection point.

13. What is meant by zero-one programming problem?

14. Write the infeasible condition in dual simplex method.

15. Give an example of integer problem in reality.

16. What are the advantages of revised simplex method over simplex method.