9. Using geometric programming, solve the following problem :

Minimize $Z = C_1x_1x_2^{-1} + C_2x_1^{-1}x_2 + C_3x_1 + C_4x_2^{-1}$

Where $C_j > 0$; $x_i > 0$; $j = 1, 2, 3, 4$ and $i = 1, 2$.

10. A ship is to be loaded with stock of 3 items. Each unit of item 'n' has a weight w_n and value v_n. The maximum Cargo weight the ship can take is 5 and the details of the three items are as follows :

Item (n)	Weight (w_n)	Vlaue (v_n)
1	2	7
2	3	10
3	1	3

Find the most valuable Cargo load without exceeding the maximum Cargo weight by using dynamic programming.

2016

Time : 4 hours

Full Marks : 100

The questions are of equal value.

*Answer any **five** questions.*

(OPERATIONS RESEARCH)

1. Use Branch and bound method to solve the following integer linear program :

Minimize $Z = 4x_1 + 3x_2$

Sbject to :

$5x_1 + 3x_2 \geq 30$

$x_1 \leq 4$

$x_2 \leq 6$

$x_1, x_2 \geq 0$ and are integers

2. State and prove Kuhn-Tucker necessary and sufficient conditions in a non-linear programming problem.

3. Solve the following non-linear programming problems using the method of Lagrangian multipliers :

Minimize $Z = 6x_1^2 + 5x_2^2$

Subject to :

$$x_1 + 5x_2 = 3 ;$$

$$x_1, x_2 \geq 0$$

4. Verify whether the following function is convex or concave and find the maximum or minimum solution point :

$f(x) = 4x_1^2 + 3x_2^2 + x_3^2 - 6x_1x_2 + x_1x_3 - \frac{x_1}{2} - 2x_1 + 15$

5. (a) Is the following two person, zero-sum game stable ? Solve the game :

Player B

$$\textbf{Player A} \begin{bmatrix} 5 & -10 & 9 & 0 \\ 6 & 7 & 8 & 1 \\ 8 & 7 & 15 & 1 \\ 3 & 4 & -1 & 4 \end{bmatrix}$$

(b) Solve the game whose payoff matrix is :

Player B

$$\textbf{Player A} \begin{bmatrix} -4 & 3 \\ -7 & 1 \\ -2 & -4 \\ -5 & -2 \\ -1 & -6 \end{bmatrix}$$

6. Solve the following quadratic program by Wolfe's method :

Maximize $Z = 2x_1 + 3x_2 - 2x_1^2$

Subject to :

$$x_1 + 4x_2 \leq 4$$

$$x_1 + x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

7. Explain Lemke's complementary pivoting algorithm for solving linear complementarity problem.

8. Explain the Kelley's cutting plane method of a non-linear, programming problem. Also, write the necessary steps for solving a non-linear programming problem.