maximum cargo weight the ship can take is 5 and the details of the three items are as follows :

Item (n)	Item (w_n)	Item (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.

2015

Time : 4 hours

Full Marks : 100

The questions are of equal value.

*Answer any **five** questions.*

Symbols used have their usual meanings.

(OPERATIONS RESEARCH)

1. Solve the following mixed integer programming problem:

   Maximize $Z = 4x_1 + 6x_2 + 2x_3$

   Subject to $4x_1 - 4x_2 \leq 5$

   $-x_1 + 6x_2 \leq 5$

   $-x_1 + x_2 + x_3 \leq 5$

   $x_1, x_2, x_3 \geq 0$: x_1 and x_3 are integers.

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

3. Minimize $f(x) = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

Subject to : $x_1 + x_2 + x_3 = 15$

$2x_1 - x_2 + 2x_3 = 20$;

$x_1, x_2, x_3 \geq 0$

associated with Lagranges method.

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

$$f(x) = 4x_1^2 + 3x_2^2 + x_3^2 - 6x_1x_1 + x_1x_3 - \frac{x_1}{2} - 2x_1 + 15$$

5. (a) Solve the following 2×3 game graphically :

Player B

Player A $\begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix}$

(b) Use dominance property to reduce the following game to 2×2 game and hence find the optimal strategies and the value of the game :

Player B

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

6. Slove the following quadratic programming problem by using Beale's method :

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

Subject to : $x_1 + 2x_2 \leq 4$

and $x_1, x_2 \geq 0$

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

8. Use Frank-Wolfe method to solve the following non-linear programming problem (NPP):

Maximize $f(x) = 2x_1 + x_2 - x_1^2$

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

$2x_1 + x_2 \leq 4$

$x_1, x_2, \geq 0$

9. Using geometric programming, solve the following problem.

Minimize $Z = c_1x_1x_2x_3 + c_2x_1x_2^{-1} + c_3x_2x_3^{-2} + c_4x_1^{-3}x_2$

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

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