Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

FIFTH SEMESTER B.TECH. (HONOS.) DEGREE EXAMINATION, DECEMBER 2018

**Course Code: EC363**

**Course Name: OPTIMIZATION TECHNIQUES**

Max. Marks: 100 Duration: 3 Hours

**PART A**

***Answer any two full questions, each carries 15 marks.*** Marks

1 a) Find the minimum, if any, of the function (5)
$f(x) = 10x^6 - 48x^5 + 15x^4 + 200x^3 - 120x^2 - 480x + 100$

b) The Burroughs garment company manufactures men's shirts and women's blouses for Walmark Discount stores. Walmark will accept all the production supplied by Burroughs. The production process includes cutting, sewing and packaging. Burroughs employs 25 workers in the cutting department, 35 in the sewing department and 5 in the packaging department. The factory works one 8-hour shift, 5 days a week. The following table gives the time requirements and the profits per unit for the two garments: (10)

| | Minutes per unit | | | |
|---|---|---|---|---|
| Garment | Cutting | Sewing | Packaging | U |
| Shirts | 20 | 70 | 12 | |
| Blouses | 60 | 60 | 4 | |

Determine optimal weekly production schedule for Burroughs to maximize profit.

2 a) Determine maximum and minimum values of the function (7)
$f(x) = 3x^4 - 4x^3 - 24x^2 + 48x + 15$

b) Maximize $F = x_1 + 2x_2 + x_3$ subject to (8)

$2x_1 + x_2 - x_3 \leq 2$, $-2x_1 + x_2 - 5x_3 \geq -6$, $4x_1 + x_2 + x_3 \leq 6$, $x_i \geq 0$, i = 1, 2, 3

using simplex method.

3 a) Write down the statement of an optimization problem and discuss the terms associated with it. (5)

b) ChemLabs uses raw materials I and II to produce two domestic cleaning solutions A and B. The daily availabilities of raw materials I and II are 150 and 145 units respectively. One unit of solution A consumes 0.5 unit of raw material I and 0.6 unit of raw material II, and one unit of solution B uses 0.5 unit of raw material I and 0.4 unit of raw material II. The profits per unit of solutions A and B are Rs.8 and Rs.10 respectively. The daily demand for solution A lies between 30 and 150 units, and that for solution B between 40 and 200 units. Use graphical method to find the optimal production amounts of A and B. (10)

## PART B

***Answer any two full questions, each carries 15 marks.***

4 a) Sunray transport company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and demand (also in truckloads) together with the unit transportation costs are as per the transportation model. The unit transportation costs, $c_{ij}$, are in 1000s of rupees. The model seeks minimum cost shipping schedule $x_{ij}$ between silo i and mill j. (i = 1, 2, 3, j = 1, 2, 3, 4). Use Northwest corner method and VAM to find the optimal solutions. (8)

| | 1 | 2 | 3 | 4 | Supply |
|---|---|---|---|---|---|
| 1 | 10 | 2 | 20 | 11 | 15 |
| 2 | 12 | 7 | 9 | 20 | 25 |
| 3 | 4 | 14 | 16 | 18 | 10 |
| Demand | 5 | 15 | 15 | 15 | |

b) Two prisoners X and Y convicted have the option to confess or not to. The consequences are given as, (7)

- If both of them confess, both go to jail for 5 years.
- If one of them confesses and the other does not, then the one who confessed turns government's witness while the other who did not confess goes to jail for 20 years.
- If both do not confess, both go to jail for one year.

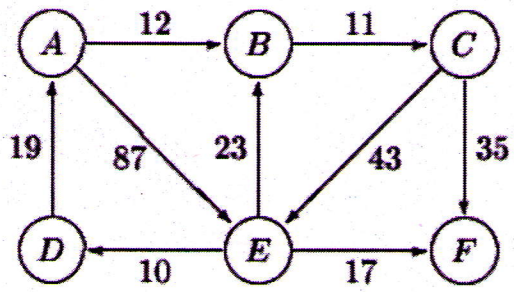
Write the pay-off matrix and also write the optimal strategy from player X's point of view.

5 a) The transportation model of a Wheat supplying company is given in the table below. (10)

| | Destinations | | | Supply |
|---|---|---|---|---|
| Sources | A.Chicago | B.St Louis | C.Cincinnati | |
| 1.Kansas | 60 | 80 | 100 | 150 |
| 2.Omaha | 70 | 110 | 110 | 175 |
| 3.Des Moines | 40 | 50 | 120 | 275 |
| Demand | 200 | 100 | 300 | |

Use MODI method to find optimum solution.

b) Solve using Djikstra's shortest path algorithm. (5)

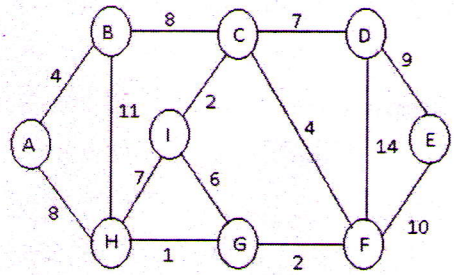



6 a) Solve the game using graphical method. (7)

| Player | B | | | | |
|---|---|---|---|---|---|
| A | 2 | -4 | 6 | -3 | 5 |
| A | -3 | 4 | -4 | 1 | 0 |

a. Find the optimal strategy for player A
b. Find the optimal strategy for player B
c. Value of the game
d. Saddle point

b) Taking node A as starting node, solve using Kruskal's minimum cost algorithm and Dijkstra's shortest path algorithm. (8)




## PART C

***Answer any two full questions, each carries 20 marks.***

7 a) Minimize $f(x) = 0.65 - \frac{0.75}{(1+x^2)} - 0.65\tan^{-1}\frac{1}{x}$ using Newton-Raphson method with starting point $x_0 = 0.1$. Use $\epsilon = 0.01$. (10)

b) Define the following terms with suitable applications: (10)
(i) Cross over (ii) Mutation.

8 a) Solve the non-linear unconstrained minimization optimisation problem by Hooke-Jeeves pattern search method by taking $\Delta x_1 = \Delta x_2 = 0.5$ and the starting point as $(x_1, x_2) = (2, -1)$ where $f(x_1, x_2) = x_1^2 + 3x_2^2 + 6x_1x_2 - x_1 - x_2$. (10)

b) Draw a flowchart of Genetic algorithm and explain different stages associated with it. (10)

9 a) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + x_2^2 + 2x_1x_2$ starting from the point $X = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Cauchy's steepest descent method.

b) Consider the following two strings denoting the vectors $X_1$ and $X_2$. (10)
$X_1 = \{1\,0\,0\,0\,1\,0\,1\,1\,0\,1\}$ $X_2 = \{0\,1\,1\,1\,1\,1\,0\,1\,1\,0\}$ Find the result of crossover at location 2. Also, determine the decimal values of the variables before and after cross over if each string denotes a vector of two variables.

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