

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019**

**Course Code: CS 365**

**Course Name: OPTIMIZATION TECHNIQUES**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- |   |  |     |
|---|--|-----|
| 1 | What is decision making under certainty with the help of a suitable example? | (3) |
| 2 | Distinguish between constrained and unconstrained optimization problem       | (3) |
| 3 | What are the steps involved in decision making procedure?                    | (3) |
| 4 | Differentiate between convex and concave functions using their graphs        | (3) |

**PART B**

*Answer any two full questions, each carries 9 marks.*

- 5 a) The marketing department of a company worked out the pay-offs in terms of yearly net profits is given by the pay-off matrix (5)

Strategies	States of nature		
	$N_1$	$N_2$	$N_3$
$S_1$	6	3.5	1.5
$S_2$	0	4.5	5
$S_3$	4	3	4

Which strategy should the concern's executive choose on the basis of

- i. Maximin criterion
  - ii. Hurwicz-criterion: (take coeff. Of optimism  $\alpha$  as 0.4 )
- b) What are Unimodal functions? (4)
- 6 a) With the help of a schematic representation, introduce the characteristics of a waiting line system. (5)
- b) Differentiate the investment cost and operating cost in objective function (4)
- 7 a) Write five typical applications of optimization (5)
- b) A woman worker has two types of jobs in a handicraft centre (i) spinning thread, (ii) knitting patterns from the thread so produced. She produces one unit of thread per hour and one unit of pattern per hour, and is paid \$ 10 per unit of thread (4)

produced and \$ 15 per unit of pattern knitted. She wants to earn not less than \$ 60 per day and wants to work not more than 6 hours a day. The thread spun should not exceed the thread consumed by more than 2 units. The centre desires that her earnings from knitting should not exceed her earnings from spinning by \$ 40. Selling profit is \$ 10 per unit of thread and \$ 20 per unit of pattern. Formulate the optimization problem to find how many units of thread and pattern should the woman produce every day to maximize her earnings?

### PART C

*Answer all questions, each carries 3 marks.*

- 8 Find an initial basic feasible solution to the transportation problem using north west corner method. (3)

	$D_1$	$D_2$	$D_3$	$D_4$	$a_i$
$O_1$	10	2	20	11	15
$O_2$	12	7	9	20	25
$O_3$	4	14	16	18	10
$b_j$	5	15	15	15	

- 9 What is mean by degeneracy in Transportation Problem? (3)
- 10 Differentiate between relative minimum and global minimum (3)
- 11 Maximize  $f(x) = x(5\pi - x)$  on  $[0, 20]$  (3)

### PART D

*Answer any two full questions, each carries 9 marks.*

- 12 a) Find the points of extremum of the function (5)
- $$f(x) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$$
- b) Find an initial basic feasible solution to the following transportation problem using Vogel's Approximation Method (4)

	$M_1$	$M_2$	$M_3$	$M_4$	SUPPLY
$P_1$	4	7	11	3	5
$P_2$	7	5	6	4	7
$P_3$	1	3	4	8	8
DEMAND	2	9	4	5	

- 13 a) Solve the following problem graphically (5)

$$\text{Min } Z = 20x_1 + 40x_2 \text{ subject to the constraints } 36x_1 + 6x_2 \geq 108$$

$$3x_1 + 12x_2 \geq 36$$

$$20x_1 + 10x_2 \geq 100$$

$$x_1, x_2 \geq 0$$

- b) Solve the assignment problem using Hungarian Method (4)

	$P_1$	$P_2$	$P_3$	$P_4$	$P_5$
$J_1$	8	6	2	4	9
$J_2$	10	1	5	5	6
$J_3$	7	2	1	8	4
$J_4$	6	7	9	10	7
$J_5$	1	5	2	1	5

- 14 a) Solve by Simplex method (5)

$$\text{Max } Z = 10x_1 + 15x_2 + 20x_3 \text{ subject to } 2x_1 + 4x_2 + 6x_3 \leq 24$$

$$3x_1 + 9x_2 + 6x_3 \leq 30$$

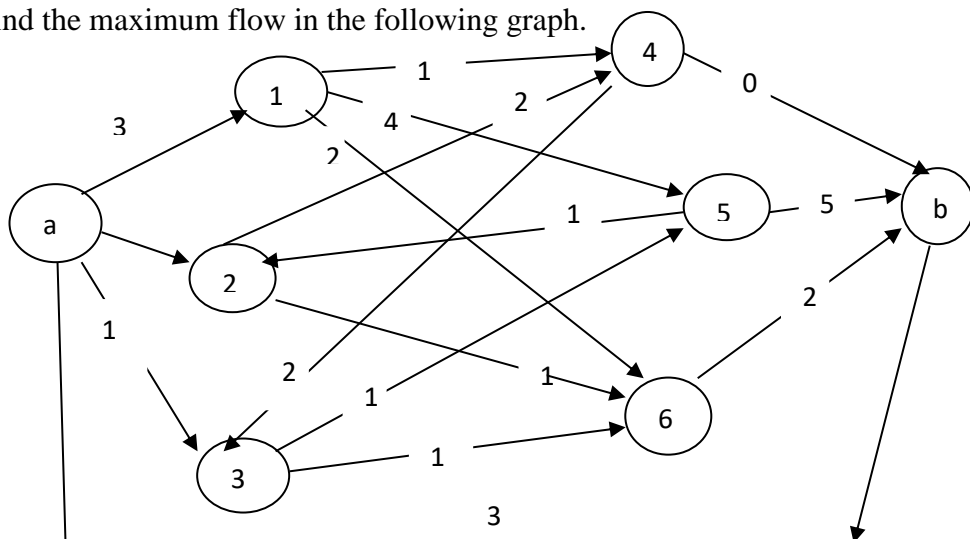
$$x_1, x_2 \geq 0$$

- b) What is an assignment problem? Can it be considered as a special case of a transportation problem? If yes, why do we prefer to solve it by an algorithm other than the transportation algorithm? (4)

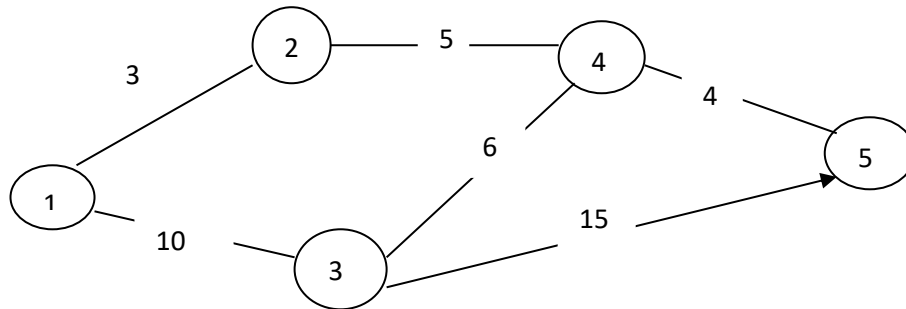
### PART E

*Answer any four full questions, each carries 10 marks.*

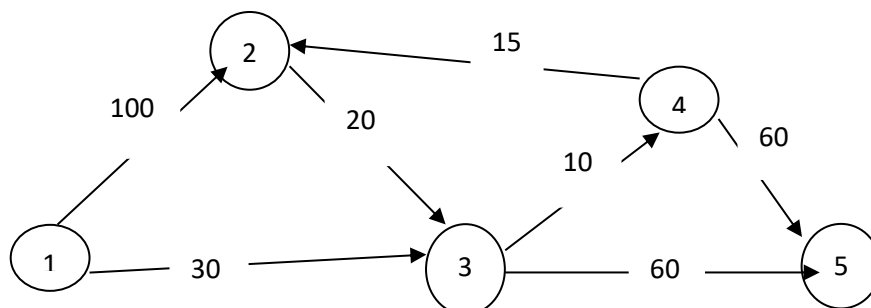
- 15 a) Find the maximum flow in the following graph. (5)



- b) What are chromosomes, genes and a gene in Genetic Algorithm (5)
- 16 a) Apply Floyd's Algorithm to find the shortest route between every two nodes for the given network. The distance in km is given on the arcs. Arc (3,5) is directional so that no traffic is allowed from node 5 to node 3. All the other arcs allow traffic in both directions. (5)



- b) Describe the simple Genetic Algorithm with the help of a flow chart (5)
- 17 a) What are the steps in Dijkstra's Algorithm (5)
- b) What are the different issues related to annealing schedules? Explain. (5)
- 18 a) The following network gives the permissible routes and their lengths in km between city 1 (node 1) and four other cities (nodes 2 to 5). Determine the shortest route from city 1 to each of the remaining four cities (5)



- b) What is Simulated Annealing? What is its advantage in optimization? (5)
- 19 a) What are NP-Hard and NP-Complete (5)
- b) With an appropriate example, explain the recombination, mutation and evaluation in solving travelling sales man problem using genetic algorithm? (5)
- 20 a) Explain initialisation procedure in simulated annealing approach to Job Shop Scheduling problem. (5)
- b) What is a Tabu Search? (5)

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