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Reg. No.

Question Paper Code

11896

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Sixth Semester

Artificial Intelligence and Data Science

20AIPW603 - OPTIMIZATION TECHNIQUES FOR PROGRAMMING WITH
LABORATORY

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

- | | <i>Marks,
K-Level, CO</i> |
|--|-------------------------------|
| 1. What is the difference between a constraint surface and a composite constraint surface? | 2,K2,CO1 |
| 2. State the various methods available for solving a multivariable optimization problem with equality constraints. | 2,K2,CO1 |
| 3. What are the differences between linear and nonlinear programming problems? | 2,K2,CO3 |
| 4. Define the golden section method. | 2,K1,CO3 |
| 5. State the six-engineering application of optimization. | 2,K1,CO4 |
| 6. What is the limitation of the linear extended penalty function? | 2,K1,CO4 |
| 7. Define the union of two fuzzy sets A and B. | 2,K1,CO5 |
| 8. What is a neural network? | 2,K1,CO5 |
| 9. What is the use of swarm optimization? | 2,K1,CO6 |
| 10. Define Ant and Bee algorithm. | 2,K1,CO6 |

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

- | | |
|---|----------|
| 11. a) (i) What are various optimization constraints? Explain in detail. | 6,K2,CO1 |
| (ii) Determine the maximum and minimum values of the function
$f(x) = 12x^5 - 45x^4 + 40x^3 + 5$. | 7,K3,CO1 |

OR

- | | |
|---|----------|
| b) (i) Apply the Karush-Kuhn-Tucker method to solve the following optimization problem. Minimize
$f(x_1, x_2) = -x_1 - x_2$
subject to
$2x_1 + x_2 \leq 4$
$2x_1 + 3x_2 \leq 6$ | 7,K3,CO1 |
|---|----------|

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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(ii) How can the Lagrange multipliers be calculated to find the optimal solution? 6,K3,CO1

12. a) Draw the flowchart for finding the optimal solution by the simplex algorithm and solve the following LPP by simplex method: 13,K3,CO3

$$\begin{aligned} \text{Maximize } F &= x_1 + 2x_2 + x_3 \\ \text{subject to } 2x_1 + x_2 - x_3 &\leq 2 \\ -2x_1 + x_2 - 5x_3 &\geq -6 \\ 4x_1 + x_2 + x_3 &\leq 6 \\ x_i &\geq 0, \quad i = 1, 2, 3 \end{aligned}$$

OR

b) Write an algorithm for the Fibonacci search method and golden section method explain with a suitable example. 13,K2,CO3

13. a) Explain in detail about Conjugate Gradient method and Newton's method in terms of optimization algorithms. 13,K2,CO4

OR

b) Construct the ϕ_k function according to the exterior penalty function approach and complete the minimization of ϕ_k for the following problem. 13,K3,CO4

$$\begin{aligned} \text{Minimize } f(x) &= (x-1)^2 \\ \text{subject to } g_1(x) &= 2-x \leq 0, g_2(x) = x-4 \leq 0 \end{aligned}$$

14. a) State Genetic algorithm. What are the basic operations used in Genetic algorithms? Explain in detail how an inequality-constrained optimization problem is converted into an unconstrained problem for use in Genetic algorithms. 13,K2,CO5

OR

b) Explain in detail neural network-based optimization and its techniques. 13,K2,CO5

15. a) Define Monte Carlo Method and explain its working methodology. 13,K2,CO6

OR

b) Describe the conceptual comparison of the firefly algorithm, bat algorithm, cuckoo search, and flower pollination algorithm. 13,K2,CO6

PART - C (1 × 15 = 15 Marks)

16. a) Solve the following LPP by dual simplex method: 15,K3,CO2

$$\begin{aligned} \text{Minimize } Z &= 3x_1 + 2x_2 \\ \text{Subjected to } 3x_1 + x_2 &\geq 3 \\ 4x_1 + 3x_2 &\geq 6 \\ x_1 + x_2 &\leq 3 \\ x_1, x_2 &\geq 0 \end{aligned}$$

OR

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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- b) (i) Find the minimum of $f = x^5 - 5x^3 - 20x + 5$ in the range $(0, 3)$ using the ant colony optimization method. Show detailed calculations for 2 iterations with 4 ants. 7,K3,CO6
- (ii) Find the maximum of the function $f = -x^5 + 5x^3 + 20x - 5$ in the range $-4 \leq x \leq 4$ using the Particle Swarm Optimization method. Use 4 particles with the initial positions $x_1 = -2$, $x_2 = 0$, $x_3 = 1$, and $x_4 = 3$. Show detailed calculations for 2 iterations. 8,K3,CO6