3/51

2111E753

Candidate's Seat No :_____

M.Sc Sem-3 Examination

502

AMS

Time : 2-30 Hours] **November-2024** **[Max. Marks : 70**

Instructions: All questions are compulsory. Use of non-programmable scientific calculator is allowed.

Q.1 **(a)** Write an algorithm of Fibonacci Search Method. (07)
Using Fibonacci search method, find the minimum for the function $f(x) = x^2 - 2.6x + 2$ in the interval $[-2,3]$. Perform 6 iterations.

(b) Write an algorithm of Golden Section Search Technique. (07)
Using Golden Section Search technique, find the minimum for the function $f(x) = e^{-x} + e^{x}$ in the interval $[-1,1]$.

OR

(a) Explain Exhaustive Search technique for minimization problems by using its graphical representation. (07)

(b) State Dichotomous Search Technique. Using Dichotomous Search technique, minimize the function $f(x) = (x-1)^2, 0 \le x \le 3$, step size is 0.10 (07)

Q.2 **(a)** Write an algorithm of Steepest Descent (Cauchy) Method. (07)
Determine the minimum of the given function
$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ using steepest descent method with initial guess $x_0 = \begin{bmatrix}0\\0\end{bmatrix}$

(b) Explain in brief Interior and Exterior penalty functions. Explain an algorithm of Interior penalty function method. (07)

OR

(a) Write an algorithm of Newton's method. (07)
Determine the minimum of the given function
$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ using Newton's method with initial guess $x_0 = \begin{bmatrix}0\\0\end{bmatrix}$.

(b) State Conjugate Gradient method (Fletcher-Reeves) and its algorithm. (07)
Using Conjugate Gradient Method, determine the minimum of the given function
$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ with initial guess $x_0 = \begin{bmatrix}0\\0\end{bmatrix}$.

Q.3 **(a)** Find the minimum of the function $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ by using Univariate method. (07)

(b) Explain Genetic Algorithm and its different stages. Also, discuss Genetic operators in brief. (07)

OR

(a) State Powell's Conjugate Direction Method and its algorithm. (07)

(P.T.O)

Find the minimum of the function $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_2x_1 + x_2^2$ by using Powell's Method, starting from the point $X_1 = (0,0)^T$.

(b) State Hooke-Jeeves Search Method and explain in detail its algorithm. (07)

Q.4 **(a)** State Master method for solving recurrences. Using Master's method find the worst time complexity of the recurrence $T(n) = 7T\left(\frac{n}{2}\right) + 18n^2$ (07)

(b) Define NP-Complete and NP-Hard problems. Explain with diagram the concept of P, NP, NP-Complete and NP-Hard. (07)

OR

(a) What is Clique? Prove that Clique decision problem is NP-complete. (07)

(b) Define Growth of Functions. Define the Asymptotic Notations: Big-oh (O), Big-Omega (ω), Big-Theta (θ) with its graphical representation. (07)

Q.5 Attempt any **SEVEN** out of **TWELVE:** (14)

(1) Which of the following asymptotic notations holds the property of Reflexivity, Symmetry and Transitivity?

A. Big Oh notations
B. Big Theta notations
C. Big Omega notations
D. Small Oh notations

(2) State any two techniques based on Region of Elimination.

(3) Draw a flowchart of the optimal design procedure.

(4) State Unimodal function. Explain its types with suitable graphs.

(5) State Exploratory and Pattern move used in Hooke-Jeeves Search Method.

(6) What is the time complexity of the following code:

```
def func(n):
  for i in range (n):
    for j in range (n):
      print (i, j)
```

A. $O(n)$
B. $O(n\ log\ n)$
C. $O(n^2)$
D. $O(n^3)$

(7) State in brief: Parabolic penalty function and Infinite Barrier penalty function.

(8) Explain in brief: Crossover and Mutation operator in Genetic Algorithm.

(9) Which of the following sorting algorithms is based on Divide and Conquer algorithmic approach?

A. Bubble sort

B. Selection Sort
C. Insertion sort
D. Quick sort

(10) State (only) Cook's Theorem.

(11) What is the worst-case time complexity of Strassen method?

A. $O(n^3)$
B. $O(n \log n)$
C. $O(n^{\ln 7})$
D. $O(\log n)$

(12) State (only) Vertex Covering Problem?

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