2603N1106

Candidate's Seat No : _____

M.Sc. Sem.-3 Examination

502

AMS

March-2025

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

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

Q.1 **(a)** 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 $[-1,1]$.

(b) Write an algorithm of Fibonacci Search Method. **(07)**

OR

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

(b) Write an algorithm of Unrestricted Search Method with fixed step size. Explain its graphical interpretation. **(07)**

Q.2 **(a)** Using Conjugate Gradient Method, determine the minimum of the given function **(07)**
$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ with initial guess $x_0 = \begin{bmatrix}0\\0\end{bmatrix}$.

(b) Determine the minimum of the given function **(07)**
$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ using steepest descent method with initial guess $x_0 = \begin{bmatrix}0\\0\end{bmatrix}$.

OR

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

(b) 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 $x_0 = \begin{bmatrix}0\\0\end{bmatrix}$.

Q.3 **(a)** State Powell's Conjugate Direction Method and its algorithm. **(07)**
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) 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)**

OR

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

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

(P.T.O)

Q.4 **(a)** Define Growth of Functions. Define the Asymptotic Notations: Big-oh (O), Big-Omega (ω), Big-Theta (θ) with its graphical representation. **(07)**

(b) What is Clique in graph? Prove that Clique decision problem is NP-complete. **(07)**

OR

(a) State Travelling Salesman Problem? Why it is NP hard Problem? **(07)**

(b) State Master method for solving recurrences. Using Master's method finds the worst time complexity of the recurrence $T(n) = T\left(\frac{n}{4}\right) + c$. **(07)**

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

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

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

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

(4) Explain with diagram the relationship between P, NP, NP-Complete and NP-Hard problems.

(5) State in brief: Parabolic penalty function with suitable example.

(6) Define the terminology of Genetic Algorithm: Chromosomes and Mutation.

(7) State (only) Vertex Covering Problem?

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

(9) What is the worst-case complexity (time) of Selection sort and Merge-sort?

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

(11) What is the worst time complexity Big (O) of the Dijkstra's Algorithm.

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

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