

Time : 2 ½ Hours

Total Marks : 60

- N.B:**
- (1) **All questions are compulsory.**
  - (2) Figures to the **right** indicate full marks.
  - (3) **Assume additional data if necessary** but state the same clearly.
  - (4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.
  - (5) Use of **calculators** and statistical tables are **allowed**.

- Q.1 Attempt **any two** of the following (12)
- a) Explain the role of a designer in the optimization process 6
  - b) What are critical points? Explain its importance to find local minimizer. 6
  - c) Golden section search uses the golden ratio to approximate Fibonacci search. Thus, explain Fibonacci and golden section search on a unimodal function. 6
  - d) Give an example of a nontrivial function where quadratic fit search would identify the minimum correctly once the function values at three distinct points are available 6
- Q.2 Attempt **any two** of the following (12)
- a) Prove that  $d^{(k+1)}$  and  $d^{(k)}$  are orthogonal using gradient decent 6
  - b) State the first order methods. Thus explain Adagrad method 6
  - c) Explain Secant Method in detail. 6
  - d) When finding roots in one dimension, when would we use Newton's method instead of the bisection method? 6
- Q.3 Attempt **any two** of the following (12)
- a) Explain how to calculate pairwise distance between point in sampling plan. 6
  - b) What is the use of Quasi-Random Sequences? Thus state the quasi-Monte Carlo method's error convergence as compared to Monte Carlo integration. 6
  - c) What is the use of Holdout method? Explain 6
  - d) Explain the linear models in detail. 6
- Q.4 Attempt **any two** of the following (12)
- a) What are different types of uncertainty explain any three. 6
  - b) 
$$f(z) \approx \hat{f}(z) = \sum_{i=1}^k \theta_i b_i(z)$$
  
In the explain two inferences of the coefficients. Thus visualize the Orthogonal basis functions for uniform, exponential, and unit Gaussian distributions. 6
  - c) What is dynamic programming? Explain 6
  - d) Explain Ant Colony optimization as an optimal approach for solving Travelling salesman's problem 6

- Q.5 Attempt **any two** of the following (12)
- a) What is Unimodality? Explain. 6
  - b) Explain the working of, RMSProp. And thus explain its advantages over Adagrad. 6
  - c) Explain how Greedy local search and the exchange algorithm can be used to find a subset of points that maximally fill a space. 6
  - d) When would we use a more descriptive model, for example, with polynomial features, versus a simpler model like linear regression 6
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