Assignment-2: Application of Classical Optimization Techniques
Course: Optimization for Data Science
Instructor: Dr. Nishant Kumar
Submission Format: IEEE Double Column (Word File and Pdf file, Both)
Submission Deadline: 9th November 2025
Total Marks: 15 Marks
Plagiarism Limit: Not more than 20% (I will Check it via Turnitin)

Dear Students,
Assignment-2 is the next stage of your previous work (*Assignment-1*).
In this task, you will **solve the optimization problem** that you had defined earlier, using **4–5 classical optimization methods**. The goal is to analyze, compare, and conclude which technique performs best for your selected problem and chosen test cases.

Task Description
You will now continue from your earlier report. Assignment-2 must include and extend your previous content (Assignment-1) into a complete 6-page IEEE paper. The total document, including both parts, **it should not exceed 6 pages.**
Your **main objectives** in this assignment are:

1. **Solve the problem** you formulated in Assignment-1 by applying **4 or 5 classical optimization methods** (as discussed in class).
2. Perform the optimization for **3–4 test cases** (the cases you already defined earlier).
3. Compare the numerical results from all the chosen methods for each case.
4. Identify and justify **which method gives the best result** and is most suitable for your problem type.

The overall goal of this paper is to determine *the most appropriate optimization technique* for a particular real-world problem (which you have selected in Assigment-1).

Report Format and Section Guidelines
Prepare the paper in **IEEE double-column format** (Times New Roman, 10 pt, single spacing).
Use the same formatting and style you used in Assignment-1.
Your Assignment-2 report should include the following sections:

❖ **Abstract (a passage of 150–200 words)**

Write a concise summary describing:
- What problem you are solving,
- Which optimization methods are applied,
- How many test cases are analyzed,
- The key finding (which method works best).

The abstract should clearly state the purpose, methods, and conclusions in one short paragraph.

❖ **Keywords**

List any **five relevant keywords** related to your work.
(Example: optimization, numerical methods, Lagrangian, convergence, minimization)

❖ **Optimization Techniques**

This section contains the **mathematical details of 4–5 classical methods** that you use for solving your problem.
You do not need to rewrite the theory yourself. You may **directly use the write-ups**, which I have provided in the *sample paper* for these methods.
From the sample paper, you can select any **4–5 methods** from the following list:
- Dichotomous Search
- Fibonacci Search
- Golden Section Search
- Bisection Method
- Line Search Method
- Steepest Descent Method
- Newton Method
- Quasi-Newton Method
- Conjugate Gradient Method

Additionally, you must include the **"Problem Formulation using the Lagrangian"** section (as shown in the sample paper) for handling constraints.
At the end of this section, include the **"Comparative Analysis of Optimization Techniques"** table, which is already provided in the sample paper. You can copy it exactly as it is.
(This means you only need to copy and paste selected 4-5 methods in this section, including equations and tables, from the sample paper.)

❖ **Results and Analysis**

This is the **main working section** of your Assignment-2.
- Solve your selected problem using all the 4–5 chosen methods.
- Perform the calculations for **each of your 3–4 cases**.
- For every case, present your results in a **table** showing:
  - Minimum (or maximum) value of the objective function
  - Corresponding variable values
  - Method used

Example Table Format (you can modify as per your variables):

Case 1: …..	f(x)	x_1	x_2	x_3	x4
Method-1	...	...	...	...	...
Method-2	...	...	...	...	...
Method-3	...	...	...	...	...
Method-4	...	...	...	...	...

Before or After each table, write a **short paragraph** explaining:
- What you observed from that case,
- How the results compare among methods, means number of iteration used, level of mathematical complexity you faced.
- Which method performs best and why.

Repeat this for all cases (Case-1, Case-2, Case-3, and Case-4 if applicable).

❖ **Conclusion (150–200 words)**

Summarize your complete work in a passage of 150-200 words:
- What problem you solved,
- What methods you applied,
- What observations you found,
- Which optimization method is most suitable for your chosen problem.

Keep the tone analytical and concise.

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6. References
- Use the **same 10–12 references** you already listed in Assignment-1.
- Add the **11 additional references** provided in the *sample paper* (copy them directly).
- Together, your final paper will have around **20–22 references**.
- Ensure all in-text citations follow IEEE numbering format ([1], [2], etc.).

Formatting and Submission Checklist

Parameter	Specification
Format	IEEE double column
Font	Times New Roman, 10 pt
Spacing	Single (1.0)
File Type	Word (.docx) and PDF
Page Limit	Maximum 6 pages (including both assignments)
Text Color	**Black only (Not Blue)**
Equation Numbering	Sequential and verified
Similarity Limit	≤ 20-25% (Turnitin)
Deadline	**9 November 2025 (Strict)**

Final Notes
- Ensure all mathematical symbols and equations are properly formatted and numbered.
- Maintain the IEEE double-column layout across all sections.
- Verify that the equations, tables, and figures are properly labeled and referenced in the text.
- Check that similarity does not exceed **20-25%**, including the reused text from Assignment-1.
- Submit both **Word and PDF** files on or before the deadline.