Project Phase - 3 (Final Project Evaluation)

- **Use Project Phase -2 code** for solving the constraints optimization problems.
- The code should have comments that will describe the steps/procedure of an optimization algorithm
  - Solve three test problems using **bracket-operator penalty method**
  - **The range on α (unidirectional search) should be found from the bounds on x vector. Therefore, no need to consider bounds on x –vector in bracket-operator penalty method.**
- Final Presentation
  - Choose a proper title of the project
  - Description of method and flow chart
  - Results and Discussion: Include your results, discuss them and also write observations
  - Conclusions: Conclude your study based on your observation with your code
- Deadline of uploading the code and presentation in a zip file is **1ˢᵗ Nov., 10 PM.**

Important points for results and discussion section:

- Mention parameter setting for the algorithm
- Run your algorithm for **10 different starting points** and tabulate the function values as (1) best, (2) worst, (3) mean, (4) median, and (5) standard deviation
- Include convergence plots of function value vs no. of iterations, Plot for no. of function evaluations vs no. of iterations, contour plots for 2-variable problems, and any other results.
- Note that in case you are not getting the correct results, those results should also be reported and write the possible reason for the same.

Appendix: Constraint Optimization Problems

Problem 1:

$$\min f(x) = (x_1 - 10)^3 + (x_2 - 20)^3,$$

$$\text{subject to } g_1(x) = (x_1 - 5)^2 + (x_2 - 5)^2 - 100 \geq 0,$$

$$g_2(x) = (x_1 - 6)^2 + (x_2 - 5)^2 - 82.81 \leq 0,$$

$$13 \leq x_1 \leq 20, \qquad 0 \leq x_2 \leq 4.$$

- Number of variables: 2 variables.
- The global minima: x* = (14.09500000000000064, 0.84296078921547956668)^T, f(x*) = -0.6961:81387558015

Problem 2:

$$\max f(x) = \frac{\sin^3(2\pi x_1)\,\sin(2\pi x_2)}{x_1^3(x_1 + x_2)},$$

$$\text{subject to } g_1(x) = x_1^2 - x_2 + 1 \leq 0,$$

$$g_2(x) = 1 - x_1 + (x_2 - 4)^2 \leq 0,$$

$$0 \leq x_1 \leq 10, \qquad 0 \leq x_2 \leq 10$$

- Number of variables: 2 variables.
- The global minima: x* = (1.227, 4.245)^T, f (x*) = 0.0958.

Problem 3:

$$\min f(x) = x_1 + x_2 + x_3$$

$$\text{subject to } g_1(x) = -1 + 0.0025(x_4 + x_6) \leq 0,$$

$$g_2(x) = -1 + 0.0025(-x_4 + x_5 + x_7) \leq 0,$$

$$g_3(x) = -1 + 0.01(-x_6 + x_8) \leq 0,$$

$$g_4(x) = 100x_1 - x_1x_6 + 833.33252x_4 - 83333.333 \leq 0,$$

$$g_5(x) = x_2x_4 - x_2x_7 - 1250x_4 + 1250x_5 \leq 0,$$

$$g_6(x) = x_3x_5 - x_3x_8 - 2500x_5 + 1250000 \leq 0,$$

$$100 \leq x_1 \leq 10000$$

$$1000 \leq x_i \leq 10000, i = 2, 3$$

$$10 \leq x_i \leq 1000, i = 4, 5, \dots, 8$$

- Number of variables: 8 variables.
- The global minima: x* = (579.3167, 1359.943, 5110.071, 182.0174, 295.5985, 217.9799, 286.4162,395.5979)^T, f (x*) = 7049.3307.