

Assignment-3 (Final Project Evaluation)

- Use Project Phase -2 code for solving the constraints optimization problems
- The code should have comments that will be describing the steps/procedure of an optimization algorithm
 - Solve three test problems using bracket-operator penalty method
- Final Presentation
 - Choose 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
- **Deadline of uploading the code and presentation in a zip file is 12 Nov. 2022, 10 PM.**

Important points for results and discussion section:

- Parameter setting for the algorithm, parameters setting for the test problems
- Run your algorithm from 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, etc.
- **Note** that in case you are not getting the correct results, those results should also be reported and write the best reason for the same.

Appendix: Constraint Optimization Problems

Problem 1:

$$\begin{aligned}\min f(x) &= (x_1 - 10)^3 + (x_2 - 20)^3, \\ \text{subject to } g_1(x) &= (x_1 - 5)^2 + (x_2 - 5)^2 - 100 \geq 0, \\ g_2(x) &= (x_1 - 6)^2 + (x_2 - 5)^2 - 82.81 \leq 0, \\ 13 &\leq x_1 \leq 20, \quad 0 \leq x_2 \leq 4.\end{aligned}$$

- Number of variables: 2 variables.
- The global minima: $x^* = (14.09500000000000064, 0.8429607892154795668)$, $f(x^*) = -0.696181387558015$

Problem 2:

$$\begin{aligned}\max f(x) &= \frac{\sin^3(2\pi x_1) \sin(2\pi x_2)}{x_1^3(x_1 + x_2)}, \\ \text{subject to } g_1(x) &= x_1^2 - x_2 + 1 \leq 0, \\ g_2(x) &= 1 - x_1 + (x_2 - 4)^2 \leq 0, \\ 0 &\leq x_1 \leq 10, \quad 0 \leq x_2 \leq 10\end{aligned}$$

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

Problem 3:

$$\begin{aligned}\min f(x) &= x_1 + x_2 + x_3 \\ \text{subject to } g_1(x) &= -1 + 0.0025(x_4 + x_6) \leq 0, \\ g_2(x) &= -1 + 0.0025(-x_4 + x_5 + x_7) \leq 0, \\ g_3(x) &= -1 + 0.01(-x_6 + x_8) \leq 0, \\ g_4(x) &= 100x_1 - x_1x_6 + 833.33252x_4 - 83333.333 \leq 0, \\ g_5(x) &= x_2x_4 - x_2x_7 - 1250x_4 + 1250x_5 \leq 0, \\ g_6(x) &= x_3x_5 - x_3x_8 - 2500x_5 + 1250000 \leq 0, \\ 100 &\leq x_1 \leq 10000 \\ 1000 &\leq x_i \leq 10000, i = 2, 3 \\ 10 &\leq x_i \leq 1000, i = 4, 5, \dots, 8\end{aligned}$$

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