Indian Institute of Technology, Bombay — Chemical Engineering
CL603: Optimization — Assignment 1, 2023
Submission Deadline: 14 Jan 2023 (Sat) by 11.59 PM (midnight).
Mode of Submission: Moodle submission and MATLAB Grader.
Important Instructions: (i) There is NO concept of LATE SUBMISSION. So, please submit by the deadline. If you don't submit by the deadline, then you won't get any credits. (ii) Students working in Matlab should submit assignment Assignment1_Matlab on moodle (and also on matlab grader: see instructions below), and (ii) Students working in Matlab should submit assignment Assignment1_Python on moodle.

Topic: Plotting

Aim

To be able to generate various types of plots useful in optimization (at least in two dimensions).

Consider the following function:

$$f(x_1, x_2) = (x_2 - x_1)^4 + 8x_1x_2 - x_1 + x_2 + 3$$

Write a python (or matlab) script to generate the following plots:

- Line plot: Plot of $f(x_1, x_2)$ versus x_1 for $x_2 = -1$ and for $x_2 = +1$. Thus, there should be two curves in this figure. Sample plot is shown in Figure 1
- Surface plot: Generate a 3d plot of the function. Sample plot is shown in Figure 2.
- Contour plot: Generate a contour plot of the function. Sample plot is shown in Figure 3.

Note:Define x_1 as a column vector of length 60 (i.e. 60 x 1) corresponding to equally spaced points in the interval$[-1, 1]$. Note that first element of x_1 will be -1 and the last element will be $+1$.

Python Code To Submit

- Submit a python script which on execution will generate the three plots. You will need to import "matplotlib.pyplot" for the same. No other input/action should be required to generate these. Thus we are not telling you the structure of the code and you are free to create it on your own. Just keep the file name as (tut01_ROLLNO.py where ROLLNO is your actual rollnumber). You can submit python file (.py extension). If you have jupyter notebook, then please submit html which includes all plots, since jupyter notebook is difficult to rerun. Get in touch with TAs for any issue.
- Make sure that the plots have labeled axes, have titles and legends (as in first figure). These things are important while plotting.

MATLAB Code To Submit

1. Submit MATLAB code on **MATLAB Grader**. Please find link for MATLAB grader. `https://grader.mathworks.com/courses/96342-cl-603-optimization/assignments/261237-\assignment-1-pl`
Your code will be auto-graded on MATLAB grader. A template file is available on matlab grader. Write your code in that template file. You can run the code to check its correctness/outputs. After you are satisfied, then submit the code. **Important: You will be able to submit the code ONLY ONCE**. After submission you will be able to see your marks and errors (if any), but will not be able to modify your code. Thus, submit only after you are satisfied with your code. Submit before the deadline.

2. Additionally, upload your MATLAB script file which you created in the Matlab grader environment, to Moodle as well. Note that Matlab grader does not give an option of saving the file on the local machine. But you can copy paste the contents of the file in a file on your machine, and then upload this file on moodle. Moodle submission is just for records. Grading will be automatically done in matlab grader environment as mentioned in item 1. While uploading on moodle, ensure that your file name is as tut01_ROLLNO.m where ROLLNO is your actual rollnumber.

Learning

You will learn the following by completing this assignment,

- Generating various types of (optimization relevant) plots in Python.

Learning is fun. Best of Luck!

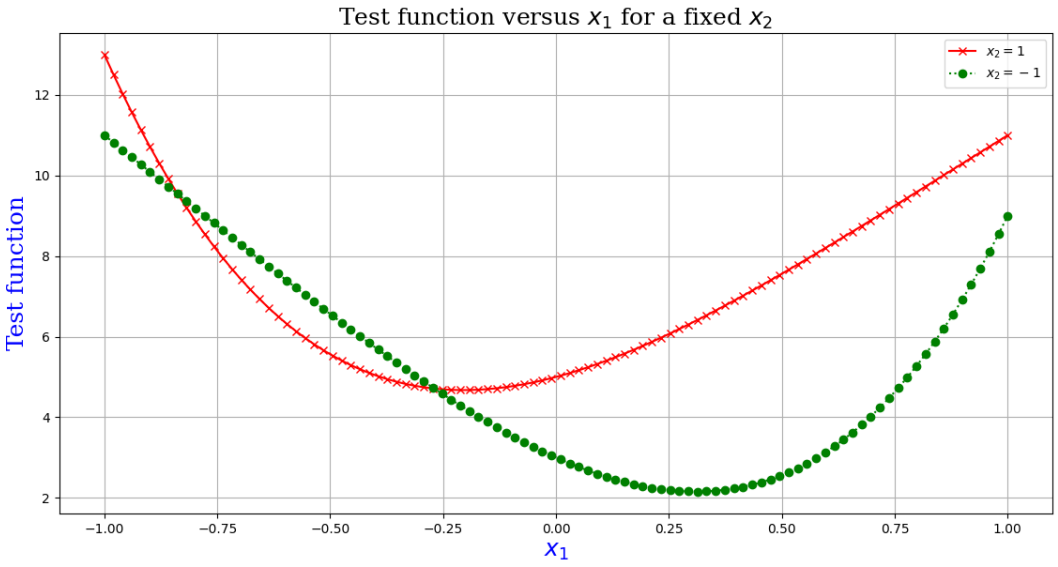

Figure 1: Line Plots for Test Function

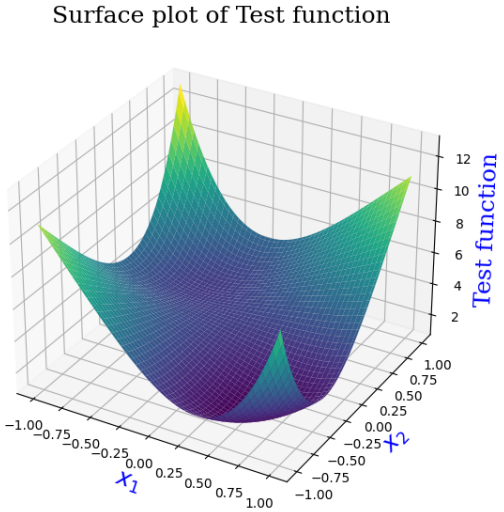

Figure 2: Surface plot for Test Function

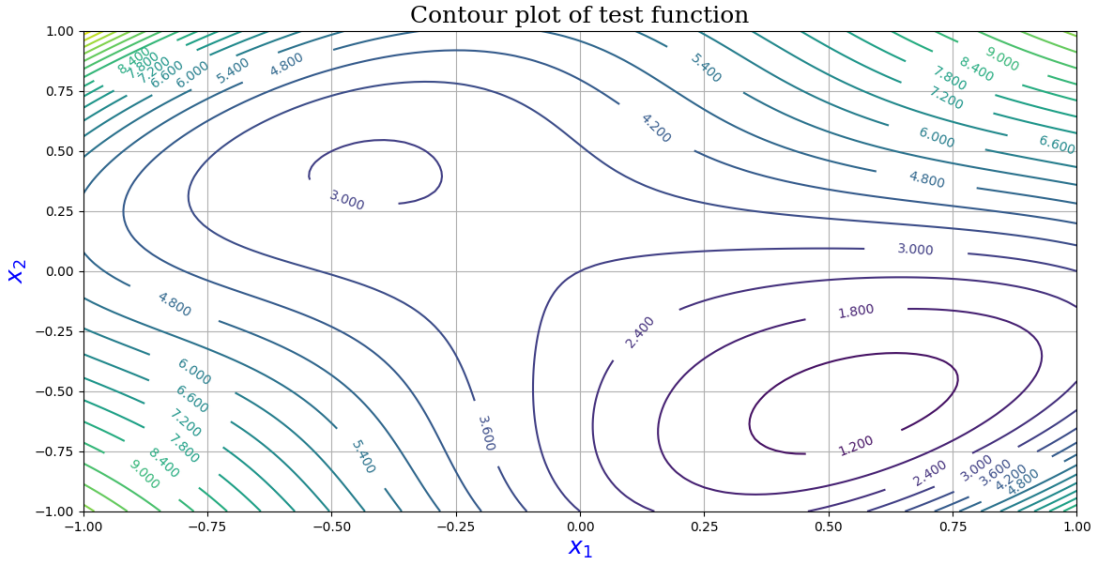

Figure 3: Contour Plot for Test Function