ME6280: Design and Optimization of Energy Systems
Programming Quiz

October 19, 2020

- Answer all the questions
- The exam is for **1 hour**
- The exam is out of **60 marks**
- The codes submitted will be analyzed by a plagiarism checker. If malpractice is detected, the scores **WILL BE NULLIFIED!**

***Instructions for submission*:**

- Create a folder in the following format ROLLNO_FIRSTNAME (ME16D022_GAURAV)
- Include the MATLAB code for each question in this folder
- Take the screenshot of the output of the MATLAB code for each question and arrange it in a .pdf file, within the same folder
- Zip the folder and upload it

Question 1 (20 marks)

Minimize:

$$f(\mathbf{X}) = x_1^2 + x_2^2 + 2x_3^2 - x_4^2 - 5x_1 - 5x_2 - 21x_3 + 7x_4 + 100$$

Subject to

(a) $x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_1 - x_2 + x_3 - x_4 - 100 \leq 0$
(b) $x_1^2 + 2x_2^2 + x_3^2 + 2x_4^2 - x_1 - x_4 - 10 \leq 0$
(c) $2x_1^2 + x_2^2 + x_3^2 + 2x_1 - x_2 - x_4 - 5 \leq 0$
(d) $-100 \leq x_i \leq 100, \qquad i = 1, 2, 3, 4$

Question 2 (20 marks)

Maximize:

$$f(\mathbf{X}) = 6x_1^2 - 11x_1 - x_3 - x_1^3$$

Subject to

(a) $x_1^2 + x_2^2 - x_3^2 \leq 0$
(b) $4 - x_1^2 - x_2^2 - x_3^2 \leq 0$
(c) $(x_2 x_3)^2 - 6 \leq 0$
(d) $x_1^5 + x_2^4 + x_3^2 - \sqrt{2}x_3 = 4$
(e) $0 \leq x_i \leq 5$, i=1, 2, 3

Question 3 (20 marks)

Answer whether each of the following quadratic forms is positive definite, negative definite or neither (while considering a symmetric matrix):

(a) $f = x_1^2 - x_2^2$

(b) $f = -x_1^2 + 4x_1x_2 - 9x_2^2 + 2x_1x_3 + 8x_2x_3 - 4x_3^2$