UNIVERSITY OF MALAYA

ALTERNATIVE ASSESSMENT FOR THE DEGREE OF MASTER OF DATA SCIENCE (Part 1)

ACADEMIC SESSION 2022/2023 : SEMESTER II

WQD7011 : Numerical Optimization

June 2023 Time : 1 hour

INSTRUCTIONS TO CANDIDATES :

Answer **ALL** questions (20 marks).

(This question paper consists of 2 questions on 2 printed pages)

1. Write an Octave/Matlab program to plot the contour of the following function:

$$f(x,y) = 2x^2 - 1.05x^4 + \frac{1}{6}x^6 + xy + y^2$$

Please take note that your program should:

- plot the range of (-2,2) for both *x* and *y*
- set the number of levels of the contour to 20
- show "colorbar" besides the contour
- save the contour you plot as "contour.jpg"

Submit both the program and "contour.jpg" which you plotted.

(5 marks)

2. Consider the following function $f(x):\mathbb{R}^3 \rightarrow \mathbb{R}$ in a linear programming problem:

$$\min f(x) = 5x_1 - 12x_2 - 10x_3 + 3x_4$$

subject to :

$$-2x_1 + 5x_2 - 3x_3 + x_4 \leq 10$$
$$5x_1 + 2x_3 = 30$$
$$x_1, x_2, x_3, x_4 \geq 0$$

a) Find the optimal solution of the function using simplex method as follow:

i. Add slack and artificial variables to convert this problem to a standard form. Identify an augmented matrix that representing the problem.

(3 marks)

ii. From the matrix, identify the initial basic feasible solution for the system, as well as the corresponding value of *f*(*x*).

(2 marks)

iii. Start the pivot process to identify the optimal solution of the problem. State the values of *x* and *f*(*x*).

(5 marks)

b) Instead of finding min *f*(*x*), find max *f*(*x*) by writing an Octave program.

(5 marks)

END