UNIVERSITY OF MELBOURNE
SCHOOL OF MATHEMATICS AND STATISTICS

MAST30013 Techniques in Operations Research **Semester 1, 2021**

Assignment 2 **Due: 5 pm, Wed, 28 April**

- Solution must be *typeset* in LaTex.
- Please submit your solution *in Canvas* by the due date.
- Show all necessary working.

1. Consider the function $f : \mathbb{R}^3 \to \mathbb{R}$:

$$f(x) = x_1^4 + x_2^4 + x_3^4 + x_1^2x_2^2 - 4x_1^3 - 12x_1x_2^2 - x_1x_2x_3 + 12x_1x_3 - 4x_3 + 1$$

You are required to do a computational study comparing the below three methods for finding the local and global minima of f.

i Steepest descent method;

ii Newton's method;

iii BFGS Quasi-Newton method.

(a) Compute the gradient and Hessian of f.

(b) Create a set of instances which consists of 1000 randomly generated initial points for the algorithms. Test the algorithms on the instance set and compare their average performance in terms of solutions found and computational time. Use the following parameters:

- tolerance $\epsilon_1 = 10^{-2}$ for the three methods,
- tolerance $\epsilon_2 = 10^{-5}$ for the Golden section search,
- step size $T = 10$,
- initial points with coordinate values range $x_i \in (-10, 10),\ i = 1, 2, 3, 4$.

i. You should report the average performance of your algorithms in tables.

f value	Minimiser	No. of times	Ave iterations per search	Ave time per search (sec)
-2	(x_1, x_2, x_3)	6	7.8	0.2157
$\vdots$				

ii. Discuss, in words, the conclusion you have arrived at from your computational study.

You need to modify the given code (f.m, GRADF.m, HESS.m and script.m) from the LMS in order to take function f as input. Only include a screenshot of the Matlab script.m in your LaTex submission. Do NOT include the other Matlab code.