<div align="center">

The University of Queensland

School of Information Technology & Electrical Engineering

Engg7302 Advanced Computational Techniques in Engineering

Assignment 2: Optimisation Question

</div>

Due date: 23/10/2024 3:00 pm

Where to submit: Submit the assignment report via the Blackboard Turnitin submission system.

Instruction:

For this assignment, you must attempt to solve different optimisation problems. For each question, you are required to report your results in detail. It should include your best solution and its corresponding solution procedures. If you are asked to solve those sub-questions using MATLAB, their MATLAB source code with detailed comments is required.
Marks will be awarded based on how well your submission addresses the above points.

This assignment is worth 10% of the total marks for the course.

Question On Optimisation

A furniture company will sell three types of chairs to UQ (types A, B, and C), all made from the same wood material. Suppose a linear equation is to be fit to predict the wood material price as a function of the quantity of these three types of chairs sold, given the following data:

Table 1

Number of type A	Number of type B	Number of type C	Price of wood material
90	10	80	50
100	80	140	20
170	30	160	90
169	31	155	100
100	90	90	40

Assume the prediction equation is $p(n) = ax(n) + by(n) + cz(n)$, where a, b, c are the prediction parameters for the quantities of chair types A, B and C to be sold, respectively. Define $x(n), y(n), z(n)$ as the observations on the number of types A, B, and C sold, respectively (see columns 1, 2, 3 in Table 1), and $p(n)$ as the observed price (see column 4 in Table 1). n identifies the observation index.

(1) Suppose the desired criterion for equation fit is that the fitted data exhibit a minimum of the sum of the absolute deviations between the wood material price and its prediction.

Please develop a Linear Programming (LP) model to minimise the sum of the absolute deviations and solve the formed LP problem using the MATLAB function-linprog.

(40 marks)

(2) Suppose the desired criterion for equation fit is that the fitted data exhibit a minimum of the largest absolute deviation between the wood material price and its prediction.

Please develop an LP model to minimise the largest absolute deviation and solve the formed LP problem using the MATLAB function-linprog.

(35 marks)

(3)

Suppose the desired criterion for the equation fit is that the fitted data exhibit a minimum sum of the squared deviations between the wood material price and its prediction. In Table 1, the first dataset is supposed to be emphasised 10 times more than the remaining four datasets. You are then asked to solve the resulting least squares (LS) problem.

-   Write down the linear system equation (Ax=B) of the LS problem.

(15 marks)

-   Solve the LS problem using the normal equations approach.

(10 marks)