MONASH University

School of Mathematics
2022 Semester 2

MAT1841 Continuous Mathematics for Computer Science

Assignment 1

*The assignment is to be submitted via MOODLE via **11:55 pm AEST Friday 26 August 2022**.*

See the instructions under the assessment tab on MOODLE. Be sure to press the "submit assignment" button to complete the submission. You must submit a single PDF document no larger than 10MB in size. It's the student's responsibility to ensure that the file is not corrupted.

Assignment 1 is worth 10% of the final mark.

The standard penalty of 10% of the total mark per day will apply for late work.

Show your working. You are required to clearly explain your steps in both English and mathematical expressions. Most of the marks will be allocated for clear working and explanations. A mathematical writing guide is available on Moodle.

1. Consider the two lines in $\mathbb{R}^3$: $\boldsymbol{r_1}(t) = (-3, 2, 2) + t(4, 0, 1)$ and $\boldsymbol{r_2}(s) = (12, 0, -9) + s(-4, 3, 0)$.

   a. Find the orientation of a vector perpendicular to both $\boldsymbol{r_1}(t)$ and $\boldsymbol{r_2}(s)$.

   b. Use a scalar projection to find the minimum distance between the two lines.

   c. Find the values of t and s at which this minimum distance is achieved.

[2 + 5 + 8 marks]

2. Derive an equation of a line formed from the intersection of the two planes,

   P1: $2x + z = 7$ and P2: $x - y + 2z = 6$.

[5 marks]

3. Find the minimum distance between the two planes,

   P1: $x - 4y + 8z = -15$ and P2: $x - 4y + 8z = 66$.

[5 marks]

4. Given the matrix $\mathbf{M} = \begin{bmatrix} 1 & 0 & -2 \\ -2 & 1 & 3 \\ -1 & -1 & 0 \end{bmatrix}$.

a. Calculate the determinant of **M**. (Show your work!)

b. Using the Gauss-Jordan algorithm, calculate the inverse of **M**.

c. Using $\mathbf{M}^{-1}$, solve the following system of equations.

$$x - 2z = -2$$
$$-2x + y + 3z = 1$$
$$-x - y = -1$$

[3 + 9 + 3 marks]

5. Given the matrix $\mathbf{M} = \begin{bmatrix} 1 & 0 & -2 \\ -2 & 1 & 3 \\ 0 & 1 & -1 \end{bmatrix}$.

a. Calculate the determinant of **M**. (Show your work!)

b. Find a value of b so that the following system has infinitely many solutions.

$$x - 2z = -2$$
$$-2x + y + 3z = 1$$
$$y - z = b$$

c. Express the solution as a line in $\mathbb{R}^3$.

[1 + 6 + 3 marks]