Assumption University of Thailand
Vincent Mary School of Science and Technology

Final Examination (online)
Semester 1/2022

Subject: ITX 2006/ CSX 2006 - Mathematics and Statistics for Data Science
Date: Wednesday, October 5, 2022
Time: 13:00 – 16:00
Lecturer: Dr. Khaing Sandar Htun (Full-time Lecturer) Section 541

Instructions:

1. Read the questions carefully and answer each question completely, legibly, and concisely.
2. Show detail of your calculation.
3. Submit your answer in **one single PDF file** and name it as **"YourName-YourID"**
4. This examination is **open-book** and the use of books and lecture notes is allowed.

Marking Scale:

The total number of marks for the 6 questions on the exam paper is 100 marks.
The total of 100 marks for this examination corresponds to 40% of the final score.

	1	2	3	4	5	6	Total
Marks Awarded							

Student Name: ______________________________ **ID:** __________________

Total: 1 Page (excluding this page)

There are 6 questions for the total of 100 marks.

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1. **(20 marks) Using your admission number** (ABCDEFG) creates the elements for the vector **u** and **v** in $\mathbf{R}^5$. Let vector **u** = (**A** – **B**, 2**C**, **D** + **E**, – **F**, 5**G**) and vector **v** = (– **F**, – **G**, **A+B**, – (**C+D**), **E+F**). For each pair of vector **u** and **v** determine the following values.
   a) **(3 marks)** Dot product of vector **u** and **v**.
   b) **(4 marks)** Norm of the vector **u** and normalized vector.
   c) **(4 marks)** Norm of the vector **v** and normalized vector.
   d) **(4 marks)** Angle between the vector **u** and **v**.
   e) **(5 marks)** Are the vector **u** and **v** orthogonal vectors in $\mathbf{R}^5$? Use the ***Pythagorean Theorem***.

2. **(20 marks)** Given the system of linear equations

$$x + 2y + 3z = 2$$
$$3x + 5y - 4z = 0$$
$$-2x - 3y + 2z = 2$$

   a) **(10 marks)** Solve the system by using the Cramer's Rule.
   b) **(10 marks)** Solve the system by using the method of Gauss-Jordan elimination.

3. **(20 marks)** Given matrix **A** = $\begin{bmatrix} 1 & -2 & 2 \\ -2 & 1 & 2 \\ -2 & 0 & 3 \end{bmatrix}$,
   a) **(15 marks)** Find the eigenvalues and corresponding eigenvectors of the matrix **A**.
   b) **(5 marks)** Find a diagonal matrix D that is similar to matrix **A**.

4. **(10 marks)** Determine whether the matrix $\begin{bmatrix} 5 & 7 \\ 5 & -10 \end{bmatrix}$ is a linear combination of the matrices $\begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$, $\begin{bmatrix} 0 & 3 \\ 1 & 2 \end{bmatrix}$, and $\begin{bmatrix} 1 & 2 \\ 0 & 0 \end{bmatrix}$.

5. **(10 marks)** Prove that the set {(1, 2, 0), (0, 1, –1), (1, 1, 2)} is linearly independent in $\mathbf{R}^3$.

6. **(20 marks)** Given matrix **B** = $\begin{bmatrix} -7 & 10 \\ -5 & 8 \end{bmatrix}$
   a) **(10 marks)** Show that the given matrix **B** is diagonalizable.
   b) **(2 marks)** Find a diagonal matrix **D** that is similar to **B**.
   c) **(8 marks)** Determine the similarity transformation that diagonalizes **B**.

End of Examination Paper
