

Assumption University of Thailand  
Vincent Mary School of Science and Technology

QUIZ II (online)  
Semester 1/2022

Subject: ITX 2006/ CSX 2006 - Mathematics and Statistics for Data Science  
Date: Monday, September 19, 2022  
Time: 09:00 – 11:00 (2 hours)  
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 5 questions on the exam paper is 80 marks.  
The total of 80 marks for this examination corresponds to 5% of the final score.

	1	2	3	4	5	Total
Marks Awarded						

Student Name: \_\_\_\_\_ ID: \_\_\_\_\_

Total: 1 Page (excluding this page)

There are 5 questions for the total of 80 marks.

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1. **(10 marks)** Is the matrix  $\begin{bmatrix} 3 & -1 & -6 \\ 3 & -2 & -8 \\ 1 & -1 & -3 \end{bmatrix}$  singular or nonsingular matrix? If it is nonsingular matrix, find its inverse by using the method of Gauss-Jordan elimination.
  
2. **(10 marks)** Determine whether the vector  $(6, -5, -6)$  is a linear combination of the vectors  $(3, 3, 1)$ ,  $(-1, -2, -1)$ , and  $(-6, -8, -3)$  in  $\mathbf{R}^3$ .
  
3. **(10 marks)** Determine that the set of vectors  $(3, 3, 1)$ ,  $(-1, -2, -1)$ , and  $(-6, -8, -3)$  are linearly dependent or independent in  $\mathbf{R}^3$ .
  
4. **(30 marks)** Given matrix  $\mathbf{B} = \begin{bmatrix} 1 & 0 & 0 \\ -2 & 1 & 2 \\ -2 & 0 & 3 \end{bmatrix}$ 
  - a) **(15 marks)** Show that the given matrix  $\mathbf{B}$  is diagonalizable.
  - b) **(3 marks)** Find a diagonal matrix  $\mathbf{D}$  that is similar to  $\mathbf{B}$ .
  - c) **(12 marks)** Determine the similarity transformation that diagonalizes  $\mathbf{B}$ .
  
5. **(20 marks)** Using your admission number (ABCDEFGH) to create the elements for the vector  $\mathbf{u}$  and  $\mathbf{v}$  in  $\mathbf{R}^5$ . (If your ID number is 6238001, use A=6, B=2, etc.) Let vector  $\mathbf{u} = (\mathbf{A} - \mathbf{B}, 2\mathbf{C}, \mathbf{D} + \mathbf{E}, -\mathbf{F}, 5\mathbf{G})$  and vector  $\mathbf{v} = (-\mathbf{F}, -\mathbf{G}, \mathbf{A} + \mathbf{B}, -(\mathbf{C} + \mathbf{D}), \mathbf{E} + \mathbf{F})$ . For each pair of vector  $\mathbf{u}$  and  $\mathbf{v}$  determine the following values.
  - a) **(2 marks)** Dot product of vector  $\mathbf{u}$  and  $\mathbf{v}$ .
  - b) **(4 marks)** Norm of the vector  $\mathbf{u}$  and normalized vector.
  - c) **(4 marks)** Norm of the vector  $\mathbf{v}$  and normalized vector.
  - d) **(5 marks)** Are the vector  $\mathbf{u}$  and  $\mathbf{v}$  orthogonal vectors in  $\mathbf{R}^5$ ? Use the Pythagorean Theorem.
  - e) **(5 marks)** Angle between the vector  $\mathbf{u}$  and  $\mathbf{v}$ .

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End of Examination Paper

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