

CSU11001 Homework III

This homework will be marked out of 20. This is an individual assignment.

Please write your **NAME** and **CSU11001** on the top of the first page.

Submit your solution online via the CSU11001 page on mymodule.tcd.ie. Your assignment should be submitted by **8pm on Wednesday 24th November**.

Q1 (10 marks)

- (a) Taking the first, third, fifth and seventh digits of your identity number in that order form a vector, \mathbf{v} , in \mathbb{R}^4 . For example, if your student identity number is

12345678 then your vector will be $\mathbf{v} = \begin{pmatrix} 1 \\ 3 \\ 5 \\ 7 \end{pmatrix}$.

- (b) Express your vector, \mathbf{v} , as a linear combination of \mathbf{v}_1 , \mathbf{v}_2 , \mathbf{v}_3 and \mathbf{v}_4 where

$$\mathbf{v}_1 = \begin{pmatrix} 1 \\ -1 \\ 2 \\ 1 \end{pmatrix}, \quad \mathbf{v}_2 = \begin{pmatrix} 3 \\ 1 \\ 2 \\ 1 \end{pmatrix}, \quad \mathbf{v}_3 = \begin{pmatrix} 0 \\ -1 \\ 3 \\ 1 \end{pmatrix}, \quad \mathbf{v}_4 = \begin{pmatrix} -1 \\ 0 \\ 3 \\ 2 \end{pmatrix}.$$

- (b) Using your answer from (a), and without doing any further calculations, explain why the vectors \mathbf{v}_1 , \mathbf{v}_2 , \mathbf{v}_3 and \mathbf{v}_4 form a basis for \mathbb{R}^4

Q2 (10 marks)

- (a) Form a 2×3 matrix using the digits of your student id number as follows: Use the 1st, 3rd and 5th digits to form the first row in the matrix and use the 2nd, 4th and 6th digits to form the second row of the matrix. For example, if your student identity number is 12345678 then your matrix will be $\begin{pmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{pmatrix}$.
- (b) Determine a basis for the column space of the matrix you have formed
- (c) Determine a basis for the null space of the matrix you have formed.

Note: To obtain full marks you must show all your workings clearly. Don't be afraid to use sentences in English to help explain what you are doing and why.

Homework Submission: Submit your work as a **SINGLE PDF FILE**. Please submit handwritten work that you have scanned or taken photos of. Remember to combine your scanned files into a single pdf if necessary. Typeset work will only be allowed in exceptional circumstances – you must obtain permission to typeset your work.