CSU11001 Homework I

This is an individual assignment.
Make sure you are aware of the college policies of plagiarism.
This homework will be marked out of 20.
Submit your solution online via the CSU11001 page on mymodule.tcd.ie.
Your assignment should be submitted by **8pm on Thursday 14th October**.

Before you begin work on the questions below you will need to use your eight digit college identity number to generate some vectors $\mathbf{x}$, $\mathbf{y}$ and $\mathbf{z}$ to work with.

The first vector will have components made up of the last three digits of your number: e.g. if your Id number is 21341234 then the components of the vector $\mathbf{x}$ will be $(2, 3, 4)$

Id number	2	1	3	4	1	2	3	4
						x_1	x_2	x_3

The second vector, $\mathbf{y}$, will have components made up of the fifth, fourth and third digit of your Id number in **that order** e.g. if your Id number is 21341234 then the components of the vector $\mathbf{y}$ will be $(1, 4, 3)$

Id number	2	1	3	4	1	2	3	4
			y_3	y_2	y_1			

Finally the third vector, $\mathbf{z}$ is made up of the fourth, fifth and sixth digits of your Id number, **taken in that order** e.g. if your Id number is 21341234 then the components of the vector $\mathbf{z}$ will be $(4, 1, 2)$.

Id number	2	0	3	4	1	2	3	4
				z_1	z_2	z_3		

If you end up with two vectors that are the identical i.e. both vectors have the same components then please add one to the second component of one of the vectors and two to the third component of the same vector e.g. if two of your vectors are both $(3, 3, 3)$ then you should replace one of them by $(3, 3 + 1, 3 + 2) = (3, 4, 5)$. If you again end up with two vectors that are the same then keep repeating the process until you end up with three distinct vectors.

Q1 (2 marks)
State your eight digit identity number and the three vectors you have generated from it.

Q2 (13 marks) Using the vectors you have found:

   (i) Find the dot (or scalar) product of $\mathbf{x}$ and $\mathbf{y}$.

   (ii) Find the cross (or vector) product of $\mathbf{y}$ and $\mathbf{z}$.

   (iii) Find the vector (orthogonal) projection of $\mathbf{x}$ onto $\mathbf{y}$

   (iv) If your three vectors are all drawn from the origin, find an equation for the plane through their end points. You can give the equation in either parametric or implicit form.

   (v) Find the distance between the point $(3, 1, 4)$ and the plane you have found in part (iv).

Q3 (5 marks)
Create a matrix A with **rows** made up of the components of your vectors $\mathbf{x}$, $\mathbf{y}$ and $\mathbf{z}$ in that order i.e.

$$A = \begin{pmatrix} x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \\ z_1 & z_2 & z_3 \end{pmatrix}$$

Then create a matrix B with **columns** made up of the components of your vectors $\mathbf{y}$, $\mathbf{x}$ and $\mathbf{z}$ in that order i.e.

$$B = \begin{pmatrix} y_1 & x_1 & z_1 \\ y_2 & x_2 & z_2 \\ y_3 & x_3 & z_3 \end{pmatrix}$$

   (i) Calculate the matrix products AB and BA.

   (ii) Is $AB = BA$? If not give a reason why not.

Note: To obtain full marks you will need to lay your work out in clear logical steps so that the reader can see exactly how you obtain one line from the previous one.

You should show all your workings clearly, in particular please use equal signs where appropriate. Don't be afraid to use sentences in English to help explain what you are doing and why.

You should use the methods taught in CSU11001 to answer these questions – if you want to use a different method then you need to provide a full justification for it and any formula you use.

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 (e.g. that created using LaTeX or Microsoft Word with equation editor) will only be allowed in execptional circumstances – please email Meriel.Huggard@tcd.ie to obtain permission to typset your work.