CSU1101 HOMEWORK 1

Q1

ID NUMBER : 2 1 3 6 5 7 6 8

$\underline{x}(7,6,8)$

$\underline{y}(3,6,5)$

$\underline{z}(6,5,7)$

Q2

(i) $\underline{x} \cdot \underline{y} = 7(3) + 6(6) + 8(5) = 97$

(ii) $\underline{y} \times \underline{z} = \begin{pmatrix} 3 \\ 6 \\ 5 \end{pmatrix} \times \begin{pmatrix} 6 \\ 5 \\ 7 \end{pmatrix} = \begin{pmatrix} 6(7) - 5(5) \\ 5(6) - 3(7) \\ 3(5) - 6(6) \end{pmatrix}$

$= \begin{pmatrix} 42 - 25 \\ 30 - 21 \\ 15 - 36 \end{pmatrix}$

$= \begin{pmatrix} 17 \\ 9 \\ -21 \end{pmatrix}$

(iii) $\text{proj}_{\underline{y}} \underline{x} = \frac{\underline{x} \cdot \underline{y}}{\|\underline{y}\|^2} \underline{y}$

$= \frac{97}{(\sqrt{3^2+6^2+5^2})^2}$ => already found $x \cdot y$ in part (i)

$= \frac{97}{70} \underline{y}$

$= \begin{pmatrix} \frac{97}{70}(3) \\ \frac{97}{70}(6) \\ \frac{97}{70}(5) \end{pmatrix} = \begin{pmatrix} \frac{291}{70} \\ \frac{291}{35} \\ \frac{97}{14} \end{pmatrix}$

(iv) $n = \underline{y} \times \underline{z} = \begin{pmatrix} 17 \\ 9 \\ -21 \end{pmatrix}$ => n is a vector perpendicular to the plane

$x(2,3,4)$ => point on the plane

$17(x-2) + 9(y-3) + 3(z-4) = 0$

$17x - 34 + 9y - 27 + 3z - 12 = 0$

$17x + 9y + 3z - 73 = 0$ => equation to the plane

(v) $17x + 9y + 3z - 73 = 0$ $\Rightarrow$ equation to the plane

$\underline{n} = \begin{pmatrix} 17 \\ 9 \\ -21 \end{pmatrix}$ $\Rightarrow$ normal vector to the plane

$x(2,3,4)$ $\Rightarrow$ point on the plane $\quad p(3,1,4)$

$\underline{v} = \begin{pmatrix} 3-2 \\ 1-3 \\ 4-0 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ 4 \end{pmatrix}$ $\Rightarrow$ positional vector between x and p

$$\| \text{proj}_{\underline{n}} \underline{v} \| = \frac{|17(3) + 9(1) + (-21)(4)|}{\sqrt{17^2 + 9^2 + (-21)^2}}$$

$$= \frac{24}{\sqrt{811}} \text{ units} \Rightarrow \text{smallest distance between point } p \text{ and the plane}$$

Q3

$$A = \begin{pmatrix} 7 & 6 & 8 \\ 3 & 6 & 5 \\ 6 & 5 & 7 \end{pmatrix}$$

$$B = \begin{pmatrix} 3 & 7 & 6 \\ 6 & 6 & 5 \\ 5 & 8 & 7 \end{pmatrix}$$

(i)

$$AB = \begin{pmatrix} 7 & 6 & 8 \\ 3 & 6 & 5 \\ 6 & 5 & 7 \end{pmatrix} \begin{pmatrix} 3 & 7 & 6 \\ 6 & 6 & 5 \\ 5 & 8 & 7 \end{pmatrix}$$

$$= \begin{pmatrix} 97 & 149 & 128 \\ 70 & 97 & 83 \\ 83 & 128 & 110 \end{pmatrix}$$

$$BA = \begin{pmatrix} 3 & 7 & 6 \\ 6 & 6 & 5 \\ 5 & 8 & 7 \end{pmatrix} \begin{pmatrix} 7 & 6 & 8 \\ 3 & 6 & 5 \\ 6 & 5 & 7 \end{pmatrix}$$

$$= \begin{pmatrix} 78 & 90 & 101 \\ 90 & 97 & 113 \\ 101 & 113 & 129 \end{pmatrix}$$

(ii) $AB \neq BA$, MATRIX MULTIPLICATION IS NOT COMMUNICATIVE.