February 17, 2015 Lecturer Dmitri Zaitsev Hilary Term 2015

Course 2E02 2015 (SF Engineers & MSISS & MEMS)

S h e e t 5

Due: at the end of the tutorial

Exercise 1

Find bases and dimensions for the row, column and null spaces of the matrix:

(i) $\begin{pmatrix} 1 & 2 & 0 \\ 1 & -1 & -1 \end{pmatrix}$;

(ii) $\begin{pmatrix} -1 & 2 \\ 3 & -6 \\ -4 & 8 \end{pmatrix}$.

Exercise 2

Find the rank and the nullity of the matrix:

(i) $\begin{pmatrix} 3 & 3 & -3 \\ -2 & -2 & 2 \end{pmatrix}$;

(ii) $\begin{pmatrix} 4 & -4 & -4 \\ 1 & 1 & 1 \\ 2 & 0 & 0 \end{pmatrix}$.

Exercise 3

Calculate the length of $\mathbf{u} = (1, 0, 1)$, the distance between $\mathbf{u}$ and $\mathbf{v} = (0, 0, 2)$ and the angle between $\mathbf{u}$ and $\mathbf{v}$

(i) with respect to the standard dot product;

(ii) with respect to the inner product given by $\langle \mathbf{u}, \mathbf{v} \rangle = u_1 v_1 + 2u_2 v_2 + 2u_3 v_3$.