Assignment 1

Problem 1

Start with the vector $u_0 = \begin{bmatrix}1\\0\end{bmatrix}$. Multiply again and again by the same "Markov matrix", A =[.8 .3 ; .2 .7]. The next three vectors are u_1, u_2 and u_3.Find out these vectors.What property do you notice for all four vectors u_0, u_1, u_2 and u_4?

Problem 2

For the vectors $v = \begin{bmatrix}3\\4\end{bmatrix}$ and $w = \begin{bmatrix}4\\3\end{bmatrix}$ test the Schwarz inequality on $v.w$ and the triangle inequality on $|v+w|$. Find $\cos\theta$ for the angle between v and w.

Problem 3

Find a unit vector a in the direction of $w = \begin{bmatrix}4\\3\end{bmatrix}$. Find a unit vector v that is perpendicular to a. How many possibilities of v?

Problem 4

Describe geometrically (line, plane or all of R^3) all linear combinations of

$$a)\ \begin{bmatrix}2\\3\\4\end{bmatrix}\ and\ \begin{bmatrix}5\\8\\11\end{bmatrix}\ b)\ \begin{bmatrix}1\\0\\0\end{bmatrix}\ and\ \begin{bmatrix}0\\3\\4\end{bmatrix}\ c)\ \begin{bmatrix}2\\0\\0\end{bmatrix}\ and\ \begin{bmatrix}0\\2\\2\end{bmatrix}\ and\ \begin{bmatrix}2\\2\\3\end{bmatrix}$$

Problem 5

In the xy plane, mark all nine of these linear combinations-

$$c\begin{bmatrix}3\\2\end{bmatrix} + d\begin{bmatrix}1\\2\end{bmatrix}$$

with c=0,1,2 and d=0,1,2

Problem 6

Find two different combinations of the three vectors u=(1,3), v=(2,7) and w=(1,5) that produce b=(0,1). If I take any three vectors u,v,w in the plane, will there always be two different combinations that produce b=(0,1)?

Problem 7

Write down three equations for c,d,e so that $cu+dv+ew=b$.

$$u = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \; v = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} \; w = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \; b = \begin{bmatrix} 2 \\ 5 \\ 9 \end{bmatrix}$$

Can you find c,d,e for this b?

Problem 8

Draw three dimensional vectors u,v,w so that their combinations $cu+dv+ew$ fill only a line. Draw vectors u,v,w so that their combinations $cu+dv+ew$ fill a plane.

Problem 9

Four corners of this cube are (0,0,0), (0,0,1), (0,1,0) and (0,0,1). Find the other four corners of this cube. Find the co-ordinates of the center of this cube. What are the center points of the six faces of this cube?