

### Math 227 Assignment 3

Due Thursday, February 8

1) “Compress” the following matrices by averaging over the indicated blocks by

i) vectorizing the matrix, writing down the appropriate matrices involved, then

ii) multiplying by an appropriate matrix to average the vector.

a) (3 points)  $A = \left[ \begin{array}{cc|c} -3 & -5 & 2 \\ 4 & 16 & -17 \end{array} \right]$

b) (6 points)  $B = \left[ \begin{array}{ccc|c} 11 & -31 & 7 & 2 \\ -88 & 9 & -12 & 0 \\ 8 & -14 & 25 & 8 \\ \hline & 2 & 5 & 6 & -1 \end{array} \right]$

2) a) (2 points) Find a nonzero vector of length one in  $\mathbb{R}^2$  that is orthogonal to  $v = \begin{bmatrix} 13 \\ 5 \end{bmatrix}$

b) (3 points) Produce a vector in  $\mathbb{R}^3$  that is orthogonal to both  $v = \begin{bmatrix} 1 \\ 5 \\ -8 \end{bmatrix}$  and  $w = \begin{bmatrix} 16 \\ -22 \\ 2 \end{bmatrix}$ , then check that your answer is correct.

c) (4 points) Find two nonparallel vectors  $v_3$  and  $v_4$  in  $\mathbb{R}^4$  that are orthogonal to  $v_1 = \begin{bmatrix} 1 \\ 5 \\ -8 \\ 13 \end{bmatrix}$  and  $v_2 = \begin{bmatrix} 16 \\ -22 \\ 2 \\ -4 \end{bmatrix}$ , then check that your answer is correct.

d) (3 points) For the vectors you found in part c), show that  $\text{span}\{v_1, v_2, v_3, v_4\} = \mathbb{R}^4$ . (Wolfram Alpha can do this).

e) (4 points) Show that, for ALL choices of nonzero, orthogonal vectors  $v_1, v_2, v_3$ , and  $v_4$  in  $\mathbb{R}^4$ ,  $\text{span}\{v_1, v_2, v_3, v_4\} = \mathbb{R}^4$ .