2017 Fall EE203001 Linear Algebra - Homework 8

Due: None

1. (0%)

   (a) What matrix transforms $(1, 0)$ into $(2, 5)$ and transforms $(0, 1)$ to $(1, 3)$?

   (b) What matrix transforms $(2, 5)$ to $(1, 0)$ and $(1, 3)$ to $(0, 1)$?

   (c) Why does no matrix transform $(2, 6)$ to $(1, 0)$ and $(1, 3)$ to $(0, 1)$?

2. (0%)

   (a) What matrix M transforms $(1, 0)$ and $(0, 1)$ to (r, t) and (s, u)?

   (b) What matrix N transforms (a, c) and (b, d) to $(1, 0)$ and $(0, 1)$?

   (c) What condition on a, b, c, d will make part (b) impossible?

3. (0%) Find the singular value decomposition of A $= \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$

4. (0%) Continue above question, Please find the pseudoinverse of A and the least square solution $\hat{x}_0$ that $b = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ for $A\hat{x}_0 = b$

5. (0%) The parabola $\mathbf{w_1} = \frac{1}{2}(x^2 + x)$ equals one at $x = 1$, and zero at $x = 0$ and $x = -1$. Find the parabolas $\mathbf{w_2}, \mathbf{w_3}$ from the conditions given below and then find $y(x)$ using $\mathbf{w_1}, \mathbf{w_2}, \mathbf{w_3}$ by linearity.

   (a) $\mathbf{w_2}$ equals one at $x = -1$, and zero at $x = 0$ and $x = 1$.

   (b) $\mathbf{w_3}$ equals one at $x = 0$, and zero at $x = 1$ and $x = -1$.

   (c) $y(x)$ equals 9 at $x = 1$ and 5 at $x = 0$ and 7 at $x = -1$.

6. (0%) Suppose T is reflection across the $45°$ line, and S is reflection across the y axis. If $\mathbf{v} = (a, b)$, find $S(T(\mathbf{v}))$ and $T(S(\mathbf{v}))$.

7. (0%) Suppose a linear T transforms (1,1) to (1,0,1) and (2,3) to (1,-1,4). Find $T(\mathbf{v})$:

   (a) $v = (3, 4)$

   (b) $v = (4, 6)$

   (c) $v = (a, b)$

8. (0%) Given $A = \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 3 \\ 1 & 1 \end{bmatrix}$.
   If $T(M) = AMB$, please find $T^{-1}(M)$ in the form (   )M(   ).