This lab assignment should be done in teams of two. Go through the exercises below and show me your results. If you don’t finish by the end of today’s class, you may show me during the next class.

Consider the matrix $A = \begin{pmatrix} 4 & -2 \\ 1 & 1 \end{pmatrix}$. Do the following exercises by hand (you can check your results with Matlab).

1. Compute the determinant of the matrix, $|A|$.

2. The trace of the matrix.

3. Which of the following matrices is the inverse of $A$?
   
   (a) $A^{-1} = \begin{pmatrix} 1/4 & -1/2 \\ 1 & 1 \end{pmatrix}$  
   (b) $A^{-1} = \begin{pmatrix} 4 & 1 \\ -2 & 1 \end{pmatrix}$  
   (c) $A^{-1} = \begin{pmatrix} 1/6 & 1/3 \\ -1/6 & 2/3 \end{pmatrix}$  
   (d) $A^{-1} = \begin{pmatrix} 1/4 & 1 \\ -1/2 & 1 \end{pmatrix}$

4. Which of the following vectors is an eigenvector of $A$? What is the corresponding eigenvalue?
   
   (a) $\mathbf{x} = (-1 \ 2)^T$  
   (b) $\mathbf{x} = (2 \ 1)^T$  
   (c) $\mathbf{x} = (0 \ 1)^T$  
   (d) $\mathbf{x} = (1 \ 0)^T$

5. Compute $(AB)^T$
6. Compute $B^T A^T$

7. Consider the vectors $x = (1 \ 2 \ 3)^T$ and $y = (-1 \ 2 \ -3)^T$.
   a) Compute the inner (dot) product $x \cdot y$.
   b) Compute the vector (cross) product $x \times y$.

8. The faces of a 10-sided die are numbered 0 through 9.
   a) If the die is rolled, what is the probability that the value of the roll is a prime number?
   b) What is the expected value of the roll?
   c) If the die is rolled twice, what is the probability that the same number is obtained both times?