

## Linear Algebra Assignment #4

Deadline: April 24, 2019

- 1) [Orthogonality] Let  $a=(1,1,1)$  and  $b=(-1,1,0)$ .
  - a) Determine whether vectors  $a$ , and  $b$  are orthogonal.
  - b) Find a basis for the orthogonal complement of  $\text{Span}\{a,b\}$ .
  - c) Find the lengths of vectors  $a$  and  $b$  and find the cosine angle between them.
  - d) Determine whether vectors  $a$ , and  $b$  are linearly independent.
- 2) [Projection] Find the projection matrix  $P$  that projects every vector  $b$  in  $\mathbb{R}^3$  onto the line in the direction of  $a = (2, 1, 2)$ . Find the column space and the nullspace of  $P$  and write a basis for that spaces.
- 3) [Least Squares] Find the curve  $y = C + D x^2$  which gives the best least squares fit to the points  $(x, y) = (0, 1), (1, 4), (2, 9)$ .
- 4) [Gram - Schmidt Process] Find the decomposition of the matrix  $A$  into a product of an orthogonal matrix and an upper triangular matrix, using Gram - Schmidt Process.

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$