ECE 712: Matrix Computations for Signal Processing
Assignment 1

This is a graded assignment. You are free to discuss this material with any other person, but the work you submit (including the computer programs) must be entirely your own. Acknowledge those you consulted with.

Due: Tues Oct 14, 2025

1. On Avenue you will see a 1000×5 data matrix $\mathbf{X}$ in file X.mat. Perform a PCA compression on this data. Explain your method carefully, and comment on the effect of varying r. Evaluate the error in the PCA reconstruction and comment.

2. Prove that the error in the PCA reconstruction is minimum with respect to basis.

3. On Avenue you will find a mean–centred, coloured random sequence $x[n]$ in file x.mat. Find the FIR digital filter impulse response $h[n]$ (with constrained 2-norm) such that the output sequence $y[n]$ has minimum variance.