

MATH 3350

R Quiz 6

Instructions

- This is a take-home exam. You may use your own resources, course resources, or those found online. However, you may not interact with any other people or AI about the exam. (You should be generating your own answers.)
- You should upload the R file containing your code and the R output (as comments) with your answers. Include commented question numbers to separate your answers but otherwise you don't need to document your code. The code should be totally self-contained, so include in the code any functions that you use.
- There is typically **no partial credit**, so carefully check your work before submission. (This includes syntax for any R code that you are asked to provide.)

1. Using the inner product $\langle A, B \rangle = \text{tr}(A^T B)$ on $\mathbf{R}^{2 \times 2}$, find $\text{proj}_B A$ for

$$A = \begin{bmatrix} 2 & 5 \\ -3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 7 & -4 \\ 6 & 11 \end{bmatrix}$$

Note: 'tr' stands for the *trace* of a square matrix, which is the sum of the diagonal entries. You can compute this in R with the code `sum(diag(A))` for a square matrix `A`.

2. Use the same inner product to find an orthogonal basis for the subspace of $\mathbf{R}^{2 \times 2}$ spanned by

$$A_1 = \begin{bmatrix} 7 & 12 \\ 5 & -8 \end{bmatrix}, \quad A_2 = \begin{bmatrix} 1 & 0 \\ 13 & 5 \end{bmatrix}, \quad A_3 = \begin{bmatrix} -6 & 14 \\ 2 & 19 \end{bmatrix}$$