Math 4326/5322 | **LINEAR ALGEBRA** | Spring 2019
Dr. Duval | **Homework**

Monday, April 15

Follow the separate general guidelines for Parts A,B,C. Be sure to include and label *all four* standard parts (a), (b), (c), (d) of Part A in what you hand in.

Orthogonal Complements and Minimization Problems

Section 6.C

A: Reading questions. Due by 2pm, Sun., 21 Apr.

1. Find $U^\perp$ for $U = \operatorname{span}((9,1,5))$ in $V = \mathbf{R}^3$. Describe $U^\perp$ geometrically in this case.
2. Verify result 6.47 (Direct sum... orthogonal complement) in the case of question 1 above.
3. Find $P_U v$ for $v = (1,2,3)$ and $U = \operatorname{span}((9,1,5))$ in $V = \mathbf{R}^3$.
4. In Example 6.58, approximating $\sin x$ by a 5th-degree polynomial, explain how $\int_{-\pi}^{\pi} |\sin x - u(x)|^2 \, dx$ is minimized using the inner product 6.59 and result 6.56 (Minimizing the distance...).

B: Warmup exercises. For you to present in class. Due by the end of class Mon., 22 Apr.

Exercises 6.C: 4, 11.

Self-Adjoint and Normal Operators (Part I): Adjoints

Section 7.A, pp. 203–208

A: Reading questions. Due by 2pm, Tue., 23 Apr.

1. Define $T\colon \mathbf{R}^2 \to \mathbf{R}^4$ by
$$T(x_1, x_2) = (2x_1 + x_2, 3x_2, x_1 - x_2, -2x_2).$$
Find a formula for T^*, the adjoint of T.
2. Provide justification for every equation in the proof of result 7.5 (The adjoint is a linear map).
3. Provide justification for every equation in the proof of result 7.6(a) (Properties of the adjoint: additivity).
4. Let T be the linear map in question 1 above. Find a vector $v \in \operatorname{null} T^*$ $(v \neq 0)$, and show $v \in (\operatorname{range} T)^\perp$, thus providing an example of result 7.7(a) (Null space and range of T^*).

B: Warmup exercises. For you to present in class. Due by end of class Wed., 24 Apr.

Exercises 7.A: 1