**DASC 2594 – Multivariable Math for Data Scientists**

**Unit 2: Vector Spaces, Eigen decompositions, Orthogonality, Symmetry, and Quadratic Forms**

**Lesson Plan 6: Orthogonality and Least Squares**

**John Tipton, 2020**

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| **Units** | **Lesson Plan 6** | **Readings** |
| **Unit 2**  **Vector Spaces, Eigen decompositions, Orthogonality, Symmetry, and Quadratic Forms** | **Essential Questions**   * What is meant by the angle between vectors? What is meant by magnitude? * What is an orthonormal basis? How is an orthonormal basis different from other bases? * How are orthonormal bases used to solve problems in data science? | Chapter 6 of Linear Algebra and It’s Applications. David C. Lay |
| **Day 1**   * Understand and apply inner products, norms, vector length, and orthogonality * Apply the properties of inner products to define distance and orthogonality * Define and understand orthogonal complements and vector subspaces * Define angles between vectors using inner products and norms |
| **Day 2**   * Identify and solve orthogonal and orthonormal sets of vectors * Identify when a matrix has orthonormal columns * Identify and use orthonormal projections |
| **Day 3**   * Understand and apply the orthogonal decomposition theorem * Use and apply the best approximation theorem using orthogonal projections * Identify an orthonormal bases using Gram-Schmidt orthogonalization * Use Gram-Schmidt to generate a QR factorization |
| **Day 4**   * Solve the least squares problem using orthogonal projections * Apply least squares to solving linear models |