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

**Unit 1: Linear Equations, Matrix Algebra, Determinants, and Invertibility**

**Lesson Plan 2: Matrix Algebra**

**John Tipton, 2020**

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| **Units** | **Lesson Plan 2** | **Readings** |
| **Unit 1**  **Linear Equations, Matrix Algebra, Determinants, and Invertibility** | **Essential Questions**   * What are the basic operations that you can use with matrices? * What properties of matrices allow for solutions to linear systems of equations? * What are different matrix structures and what do these different matrix forms imply? * What is a vector space and how are subspaces defined? * What is the relationship between rank, linear independence, and vector subspaces? | Chapter 2 of Linear Algebra and It’s Applications. David C. Lay |
| **Day 1**   * Define and use vector and matrix operations   + Scalar and matrix addition and multiplication * Understand and use the row-column form of matrix multiplication * Understand and apply matrix powers * Understand and apply matrix transpose * Understand and identify a determinant * Use the determinant to identify if a matrix is invertible * Define and describe what it means for a matrix to be singular/nonsingular |
| **Day 2**   * Solve for a matrix inverse using matrix augmentation and reduced row echelon form * Solve linear equations using matrix inverse * Understand and apply the properties of matrix inverses * Understand and apply the invertible matrix theorem * Understand and apply invertible linear transformations |
| **Day 3**   * Identify and construct partitioned matrices * Understand and apply the properties of addition, multiplication, and inversion for partitioned matrices * Identify and use block diagonal matrices * Use the LU factorization to solve a system of linear equations * Understand the use of LU factorization to "pre-whiten" Gaussian random variables * Apply invertible matrix transformations and factorization to data science examples |
| **Day 4**   * Understand and apply the definitions of vector subspaces of * Understand the definition of the columnspace and nullspace of a matrix * Understand how the columnspace forms a basis set * Demonstrate applications of columnspaces and bases in data science |
|  | **Day 5**   * Define and apply coordinate systems * Identify the dimension of a vector space and rank of a matrix * Define the rank theorem, basis theorem, and the invertible matrix theorem |  |