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

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

**Lesson Plan 1: Introduction to Linear Systems of Equations**

**John Tipton, 2020**

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| **Units** | **Lesson Plan Introduction to Linear Systems of Equations** | **Readings** |
| **Unit 1**  **Linear Equations, Matrix Algebra, Determinants, and Invertibility** | **Essential Questions**   * What is a linear system of equations? * How can a linear system of equations be expressed in matrix form? * What are the techniques and tools for working with matrix equations and how to manipulate matrices * What is linear independence? Why is linear independence important? * How are matrix operations interpreted as transformations? * What are the geometric interpretations of matrix transformations? | Chapter 1 of Linear Algebra and It’s Applications. David C. Lay |
| **Day 1**   * Identify a system of linear equations * Define the augmented matrix form * Understand and apply elementary row and matrix operations including replacement, interchange, and scaling to solve augmented systems of equations * Identify if a solution to a system of equations exists and is unique |
| **Day 2**   * Reduce a matrix to (row) echelon form using fundamental matrix operations * Identify a matrix in reduced row echelon form * Identify pivot positions and pivot columns * Use reduced row echelon algorithms to solve systems of linear equations * Identify and interpret vector equations in and * Understand and apply properties of scalar/vector addition |
| **Day 3**   * Understand vector equations and linear combinations * Gain an intuition of the span of a vector using linear combinations * Interpret the matrix equation Ax = b as a linear combination * Identify if the matrix equation Ax = b has a solution * Compute the solution of the matrix equation Ax = b * Identify and apply the properties of the matrix/vector product Ax |
| **Day 4**   * Identify solution sets of the linear equation Ax = b * Identify and find solutions of the homogeneous Ax = 0 * Identify and find solutions of the inhomogeneous Ax = 0 in a parametric form * Understand and interpret solutions to the linear equation Ax = b in different application domains |
| **Day 5**   * Identify if a set of vectors is linearly dependent * Define and interpret linear independence * Understand and apply the definition of span * Identify and apply linear transformations * Identify and use the properties of linear transformations |
| **Day 6**   * Use matrices to represent linear transformations * Identify and use matrix transformations   + Reflections   + Horizontal/vertical contraction and expansion   + Horizontal and vertical shear   + Projections * Define and interpret one-to-one and onto mappings from matrices |