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

**Unit 4: Multivariable Functions, The Chain Rule, and Partial Derivatives**

**Lesson Plan 11: Optimization and Lagrange Multipliers**

**John Tipton, 2020**

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| **Units** | **Lesson Plan 11** | **Readings** |
| **Unit 4**  **Multivariable Functions, The Chain Rule, and Partial Derivatives** | **Essential Questions**   * What is the gradient? Why is the gradient important in data science? * How do you solve for minima/maxima of multivariable functions? * What are Lagrange multipliers? How are Lagrange multipliers used to solve constrained optimization problems? | Chapter 15 in Briggs et. al. |
| **Day 1**   * Use gradients to solve for minimum and maximum values * Define and identify the critical point of a surface * Define and identify saddle points * Apply the second derivative test to identify local min/max/saddle points |
| **Day 2**   * Identify and solve for absolute minimum values * Find absolute maximum/minimum values on closed, bounded sets * Understand the difficulty in finding absolute maximum/minimums on open or unbounded regions |
| **Day 3**   * Demonstrate how directional derivatives are used in data science to solve optimization problems |
| **Day 4**   * Apply and use Lagrange multipliers to solve minimums/maximums over constrained surfaces * Understand the properties of Lagrange multiplies in higher dimensions |