# CS 590 Special Topics: Programming and Data Science for Applied Research

| | R programming | Python Programming |
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| **Time** | *M, 1:30 - 2:45 pm* | *M, 3:00 - 4:15 pm* |
| **Week 1** | Anaconda Distribution Install and Overview; Anaconda Prompt Setup for Juptyer Notebook Install; Jupyter Notebooks and Course Overview | |
| **Week 2** | Introduction to R Basics | Introduction to Python Basics |
| | Arithmatic in R | Arithmatic in Python |
| | Variables | Variables |
| | R Basic Data Types | Strings |
| | List Basics | Indexing and Slicing with Strings |
| | Vector Basics | Print Formatting |
| | Vector Operations | List Basics |
| | Comparison Operators | Dictionary Basics |
| | Vector Indexing and Slicing | Tuples with Python |
| | R Basics Training Exercise | Sets in Python |
| | | Booleans in Python |
| | | Comparison Operators |
| | | Python Basics Training Exercise |
| **Week 3** | R Basics Training Exercise - Solutions | Python Basics Training Exercise - Solutions |
| | Introduction to R Matrices | Introduction to Numpy |
| | Creating a Matrix | Numpy Arrays |
| | Matrix Arithmetic | Numpy Array Indexing and Slicing |
| | Matrix Operations | Numpy Matricies |
| | Matrix Selection and Indexing | Numpy Matrix Arithmetic |
| | Factor and Categorical Matrices | Numpy Matrix Operations |
| | Matrix Training Exercies | Numpy Training Exercise |
| **Week 4** | Matrix Training Exercies - Solutions | Numpy Training Exercise - Solutions |
| | Introduction to R Data Frames | Introduction to Pandas |
| | Data Frame Basics | Pandas Series |
| | Data Frame Indexing and Selection | Pandas DataFrame Basics |
| | Data Frame Operations | Pandas DataFrame Operations |
| | Data Frame Training Exercise | Pandas DataFrame Training Exercise |
| **Week 5** | Data Frame Training Exercise - Solutions | Pandas DataFrame Training Exercise - Solutions |
| | Introduction to Data Input and Output with R | Introduction to Data Input and Output with Python |
| | CSV Files with R | I/O File Basics |
| | Excel Files with R | CSV Files with Pandas |
| | SQL with R | Excel Files with Pandas |
| | Web Scraping with R | Web Scraping with Python |

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| **Week 6** | Introduction to Programming Basics (Part I) | Introduction to Programming Basics (Part I) |
| | Logical Operators | Logical Operators |
| | IF, ELSE and ELSE IF Statements | IF, ELSE and ELSE IF Statements |
| | Conditional Statements Training Exercise | Conditional Statements Training Exercise |
| **Week 7** | Conditional Statements Training Exercise - Solutions | Conditional Statements Training Exercise - Solutions |
| | Introduction to Programming Basics (Part II) | Introduction to Programming Basics (Part II) |
| | While Loops | While Loops |
| | For Loops | For Loops |
| | Functions | Functions |
| | Functions Training Exercise | Functions Training Exercise |
| **Week 8** | Functions Training Exercise - Solutions | Functions Training Exercise - Solutions |
| | Advanced R Programming | Advanced Python Programming |
| | Built-in R Features | Built-in Python Features |
| | Apply | Lambda Expressions |
| | Math Functions in R | Map Function in Python |
| | Regular Expressions | Filter Function in Python |
| | Dates and Timestamps | |
| | Advanced R Programming Training Exercise | Advanced Python Programming Training Exercise |
| **Week 9** | Advanced R Programming Training Exercise - Solutions | Advanced Python Programming Training Exercise - Solutions |
| | Data Manipulation in R | Introduction to Object Oriented Programming in Python |
| | Dplyr | Attributes and Class Keyword |
| | Pipe Operator | Class Object Attributes and Methods |
| | Tidyr | Inheritance, Polymorphism and Special Methods |
| | Data Manipulation Training Exercise | Object Oriented Programming Training Exercise |
| **Week 10** | Guest Lecturer: SQL Programming and Data Visualizations using Tableau | |
| **Week 11** | Data Manipulation Training Exercise - Solutions | Object Oriented Programming Training Exercise - Solutions |
| | Data Visualizations with R | Data Visualizations in Python |
| | ggplot2 Basics | Matplotlib |
| | Two-variable plotting | Seaborn |
| | Corrdinates and Faceting | Pandas Built-in Data Visualizations |
| | Themes | Plotly and Cufflinks |
| | Interactive Plots with Plotly | Geographical Plotting |

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| | ggplot2 Training Exercise | Data Visualizations in Python Training Exercise |
| **Weeks 12-15** | ggplot2 Training Exercise - Solutions | Data Visualizations in Python Training Exercise - Solutions |
| | Introduction to Machine Learning | Introduction to Machine Learning |
| | Linear Regression | Linear Regression |
| | Logistic Regression | Logistic Regression |
| | K Nearest Neighbors | K Nearest Neighbors |
| | Decision Trees and Random Forests | Decision Trees and Random Forests |
| | Support Vector Machines | Support Vector Machines |
| | Principal Component Analysis | Principal Component Analysis |
| | K-Means Clustering | K-Means Clustering |
| | Neural Networks | Neural Networks |
| **Final (12/16)** | 2414 Williams Hall, Course Project Presentations | |

**Important Course Information:**
Course GitHub Page: jcdunne/CS590 (Branches: Course Content, R, Python)
NBViewer (Jupyter.org): jcdunne/CS590 (Branches: R or Python)
Binder Rendering (mybinder.org): jcdunne/CS590 (Branches: R or Python)

**Contact Information:**
Office Location: Room 210, Method Road Greenhouse Unit #3
Email: jcdunne@ncsu.edu
Phone: 314.610.6568