

IT-2091: DATA ANALYTICS PROGRAMMING

Cuyahoga Community College

Viewing: IT-2091 : Data Analytics Programming

Board of Trustees:

May 2026

Academic Term:

Fall 2026

Subject Code

IT - Information Technology

Course Number:

2091

Title:

Data Analytics Programming

Catalog Description:

Introduction to R programming with emphasis on data analysis. Students learn fundamental concepts of R, including data structures, visualization, and statistical methods, and apply them to real-world case studies across multiple disciplines.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

2

Requisites

Prerequisite and Corequisite

IT-1026 Introduction to Computing, IT-1051 Introduction to Programming, and IT-2070 Introduction to Data Science and Analytics.

Outcomes

Course Outcome(s):

Install and demonstrate use of data analytics tool to import, graph, wrangle and tidy data for effective data transformation.

Objective(s):

1. Define the taxonomy for understanding well-designed data graphics and the importance of patterns in visualizing data.
2. Explain and demonstrate the process of wrangling data.
3. Explain and demonstrate the process of data tidying.

Course Outcome(s):

Use statistical methods and models to quantify patterns and their strength and provide meaning from data.

Objective(s):

1. Practice key statistical methodologies to connect samples, data and populations.
2. Define and apply supervised and unsupervised learning models to explain the relationship between variables.
3. Create simulation models to create data from speculation.
4. Explain the concept of interactive data graphics as a means to data understanding.

Course Outcome(s):

Apply data modeling techniques to heterogeneous data.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Discuss and demonstrate how regular expressions can be used to process data.
 2. Demonstrate methods to create efficient databases to optimize query speeds.
 3. Build and interpret models that include spatial data.
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Methods of Evaluation:

1. Participation and discussion
2. Online research
3. Written reports
4. Demonstrations
5. Projects
6. Tests
7. Quizzes

Course Content Outline:

1. Data Science overview
 - a. Datasets and course example files
 - b. Professional ethics
 - c. Installation and overview of statistical tool
 - d. Objects and packages
 - e. Importing and exporting data
 - f. Data frames
2. Data visualization
 - a. Variable relationships
 - b. Taxonomy of data graphics
 - c. Scatter plots, histograms and cartesian plots
 - d. Coordinate systems
 - e. Scale, guides, facets, layers
 - f. Canonical data graphics in R
 - g. Univariate and Multivariate displays
3. Data wrangling
 - a. Functions (select), (filter), (mutate), (arrange), (summarize)
 - b. Joins
4. Tidy data
 - a. Cases and variables
 - b. Categorical and quantitative variables
 - c. Gather(), spread(), and apply() functions
 - d. Iteration over subgroups
 - e. Data cleansing
5. Statistics and modeling
 - a. Vectors, matrices, and arrays
 - a. Lists
 - b. Sampling distribution concepts
 - c. Bootstrap method
 - d. Outliers
 - e. p-values
 - f. Predictive analytics
 - g. Analysis of variance (ANOVA)
 - h. Regression and multiple regression
 - i. Bayes theorem
 - j. Artificial neural networks
 - k. Evaluating models

- l. Measuring prediction error
- m. Unsupervised learning
 - i. Clustering
 - ii. K-means
 - iii. Dimension reduction
- 6. Simulation
 - a. Randomizing functions
 - b. Simulating variability
 - c. Random networks
- 7. Report generation
 - a. Portable Document Format (PDF)
 - b. Hypertext mark-up language (HTML)
- 8. Creating Web applications

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: <https://portal2.tri-c.edu/ReligiousAccommodation/> Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

<https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf>

Weekly Schedule

	Topics
Week 1	About Data; Identifying Data Problems, Installing R
Week 2	Getting Started with R, Math Variables and Vectors
Week 3	Follow the Data, Rows and Columns, Building and Importing Datasets
Week 4	Data Munging, Summarizing Filtering and Sorting Data Frames
Week 5	Onward with RStudio, Functions and Packages
Week 6	Writing Functions
Week 7	The Use of Statistics; Histograms and Scatter Plots
Week 8	Sampling methods, types, and techniques Midterm
Week 9	Storage Wars, SQL, JSON
Week 10	Pictures vs. Numbers, Basic ggplot, Bar and scatter plott
Week 11	Map Basics, Zooming
Week 12	Word Perfect, Word Cloud
Week 13	Web Apps, Defining Big Data
Week 14	Lining up our models
Week 15	Data Mining, Vectors
Week 16	Final Exam

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

"An Introduction to Data Science" by Jeffrey S. Saltz; Jeffrey M. Stanton

R Studio Cheat Sheet

- W3Schools Documentation: <https://www.w3schools.com/r/default.asp>
 - Syntax
 - Writing Comments
 - Variables
 - Data Types
 - Math
 - Vectors
 - Mean
 - Data Frames
 - Data Set
- Wikipedia – Data Wrangling, Data Tidying
- Study Trails – Print values on R console or file
- Github – Writing Functions
- cran.r-project – Writing your own functions
- Atlassian – A complete guide to histograms
- DataScienceDojo – 7 types of statistical distributions with practical examples
- Qualtrics – Sampling methods, types, and techniques
- Deloitte – How can organizations engineer quality software in the age of generative AI?

Resources for the Instructor

Mccoy, Scott. *R for Data Analytics*. Mike Murach & Associates Inc., 2023.

Juretic, Francisco. *R Statistics Cookbook: Over 100 recipes for performing complex statistical operations with R 3.5*. Packt Publishing, 2019.

Shmueli, G., Bruce, P. C., Yahav, I., Patel, N. R., & Lichtendahl, K. C. *Machine Learning for Business Analytics: Concepts, Techniques, and Applications in R*. 2nd ed. Hoboken, NJ: John Wiley & Sons, 2023.

Saltz, J. S., Stanton, J. M. (2018) *An introduction to data science*, Thousand Oaks, CA: SAGE Publications, Inc.

Lander, J. P. (2017) *R for everyone: advanced analytics and graphics*, Boston: Addison-Wesley.

Additional Resources for the Instructor

1. R tutorial at w3schools: <https://www.w3schools.com/r/>. 2025.
2. R Tutorial for Beginners: Learn R Programming Language: <https://www.guru99.com/r-tutorial.html>

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