Syllabus

MET CS 544
Foundations of Analytics and Data Visualization
Course Syllabus

Instructor

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Course Duration

Start: January 20, 2026

End: May 8, 2026

Course credits

4 credits

Course Description

The goal of this course is to provide students with the mathematical and practical background required in the field of data analytics. Starting with an introduction to probability and statistics, the *R* tool is introduced for statistical computing and graphics. Different types of data are investigated along with data summarization techniques and plotting methods. Data populations using discrete, continuous, and multivariate distributions are explored. Sampling methods and errors during measurements and computations are analyzed in the course. String manipulations and data wrangling methods are examined in detail. The concepts covered in the course are demonstrated using *R*. This is a laboratory course.

Course Prerequisite

Basics of statistics, programming, quantitative methods or equivalent foundational course in information systems.

Technical Note

The table of contents expands and contracts (+/- sign) and may conceal some pages. To avoid missing content pages, you are advised to use the next/previous page icons in the top right corner of the learning modules.

Learning Objectives

By successfully completing this course you will be able to:

- Acquire the basic concepts of *R*
- Model random experiments using *R*
- Analyze univariate, bivariate, and multivariate data
- Learn various discrete and continuous probability distributions
- Understand sampling methods and errors
- Understand string manipulation methods and regular expressions
- Perform data wrangling tasks using the tidyverse suite of R packages

Course Outline

Module 1 – Introduction

- Introduction to Statistics and Probability
- Basic Concepts of *R* Data Types and Structures

Module 2 – Probability

- Probability
- Conditional Probability
- Random Variables
- Basic Concepts of *R* Programming Constructs

Module 3 – Data Description

- Univariate Data
- Bivariate Data
- Multivariate Data

Module 4 – Distributions

- Discrete Distributions
- Continuous Distributions

Module 5 – Sampling and Errors

- Central Limit Theorem
- Sampling Methods

- Errors, Measurement of Errors
- Biases, Noise, Data Dredging
- Resampling Methods

Module 6 – Strings, Data Wrangling

- Strings and Regular Expressions
- Data Wrangling

Materials

Recommended Books

Kerns, G. J. (2010). Introduction to probability and statistics using R.

ISBN-13: 978-0557249794

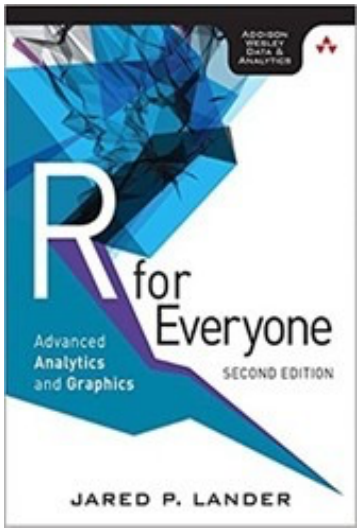
ISBN-10: 0557249791

This book is available for download (http://ipsur.r-forge.r-project.org/book/download/IPSUR.pdf).

Verzani, J. (2014). Using R for introductory statistics (2nd ed.). Chapman & Hall.

ISBN 9781466590731.

This book can be purchased from Barnes & Noble at Boston University (http://bu.bncollege.com/).



Lander, J. (2017). R for Everyone: Advanced Analytics and Graphics (2nd ed.). Addison-Wesley Professional.

ISBN 978-0134546926.

This book can be purchased from Barnes & Noble at Boston University (http://bu.bncollege.com/).

MathJax

Variables, formulae, and equations in this course are rendered using MathJax (http://mathjax.org/).

To enable its features in your browser, right-click (or ctrl-click on a single-mouse-button Mac) on a variable or equation to see your MathJax settings.

MathJax can be used with the MathPlayer (https://docs.wiris.com/mathplayer/en/mathplayer-user-manual.html) plugin for Internet Explorer, which converts math to speech and highlights the math as it is spoken.

Study Guide

Please refer to the Study Guide to help you navigate important dates in the course, including classroom session schedules and deadlines for submitting deliverables.

This course officially starts on Monday, January 19, 2026. Since January 19 is a holiday, the first class will be hosted on Monday, January 26, 2026. The course consists of 6 modules. Each of the modules spans a two-week period. Please refer to this Study Guide to assist you in planning your time.

Module 1 Study Guide and Deliverables

Topics:	Introduction to Statistics and R
Readings:	Lecture material
Discussions:	Introduction postings due Saturday, January 24, 2026 at 6:00 AM ET
Assignments:	Assignment 1 due Monday, February 9, 2026 at 6:00 AM ET

Assessments:	Quiz 1 due Monday, February 9, 2026 at 6:00 AM ET
Classes:	• Monday, January 26, 2026 from 6:00 PM to 8:45 PM ET • Monday, February 2, 2026 from 6:00 PM to 8:45 PM ET

Module 2 Study Guide and Deliverables

Topics:	Probability, Conditional Probability, R Programming
Readings:	Lecture material
Assignments:	Assignment 2 due Monday, February 23, 2026 at 6:00 AM ET
Assessments:	Quiz 2 due Monday, February 23, 2026 at 6:00 AM ET
Classes:	• Monday, February 9, 2026 from 6:00 PM to 8:45 PM ET • Tuesday, February 17, 2026 from 6:00 PM to 8:45 PM ET

Module 3 Study Guide and Deliverables

Topics:	Data Visualization, Univariate, Bivariate, and Multivariate Data Descriptions
Readings:	Lecture material
Assignments:	Assignment 3 due Monday, March 16, 2026 at 6:00 AM ET
Assessments:	Quiz 3 due Monday, March 16, 2026 at 6:00 AM ET

Classes:	• Monday, February 23, 2026 from 6:00 PM to 8:45 PM ET • Monday, March 2, 2026 from 6:00 PM to 8:45 PM ET • Monday, March 16, 2026 from 6:00 PM to 8:45 PM ET (working in-class on the term project)

Module 4 Study Guide and Deliverables

Topics:	Probability Distributions - Discrete & Continuous
Readings:	Lecture material
Assignments:	Assignment 4 due Monday, April 6, 2026 at 6:00 AM ET
Assessments:	Quiz 4 due Monday, April 6, 2026 at 6:00 AM ET
Classes:	• Monday, March 23, 2026 from 6:00 PM to 8:45 PM ET • Monday, March 30, 2026 from 6:00 PM to 8:45 PM ET

Module 5 Study Guide and Deliverables

Topics:	Central Limit Theorem, Sampling and Resampling Methods
Readings:	Lecture material
Assignments:	Assignment 5 due Monday, April 22, 2026 at 6:00 AM ET
Assessments:	None

Assessments:	None
Classes:	• Monday, April 6, 2026 from 6:00 PM to 8:45 PM ET • Monday, April 13, 2026 from 6:00 PM to 8:45 PM ET

Module 6 Study Guide and Deliverables

Topics:	Strings, Data Wrangling
Readings:	Lecture material
Assignments:	Assignment 6 due Monday, May 4, 2026 at 6:00 AM ET
Assessments:	None
Classes:	• Wednesday, April 22, 2026 from 6:00 PM to 8:45 PM ET • Monday, April 27, 2026 from 6:00 PM to 8:45 PM ET (Optional. To be announced if it will take place.)

Course Evaluations

Please complete the course evaluation once you receive an email or Blackboard notification indicating the evaluation is open. Your feedback is important to MET, and we would appreciate it very much, as it helps us make improvements to the program and the course for future students. Please note that the course evaluations are anonymous, and your feedback will not be shared with MET until the course has ended.

Final Exam

You will complete your final exam during an on-campus class session. Your final exam will typically be graded by the end of the semester.

The Final Exam will take place on May 4, 2026 at 6:00 PM ET and will cover the entire course material from Modules 1-6

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The duration of both the Final Exam is: **2 hours (120 minutes)**

The final exam will be **closed book/closed notes** exam. You cannot bring any materials or devices to the exam. You cannot access any web-based content or computer-stored content other than the course exam during the two-hour period.

Exam Parameters:

- Textbook: None allowed.
- Materials: None allowed.
- Internet Resources: None allowed.
- Software: None allowed.
- Calculator: None allowed.
- Scratch Paper: Use of 3 pieces of blank scratch paper is allowed.

You can take the exam only once.

Grading Information

The course is divided into modules. Each module runs for two weeks. Please check the **Study Guide** for the classroom session schedules and deadlines for submitting deliverables.

Grading Structure and Distribution

The grade for the course is determined by the following:

Overall Grading Percentages

Assignments	20%
Quizzes	20%
Term project	35%
Final Exam	20%
Class Participation	5%

Numerical / Letter Grade Equivalents

95 - 100	A

90 - 95	A-
85 - 90	B+
80 - 85	B
75 - 80	B-
70 - 75	C+
65 - 70	C
60 - 65	C-
<60	F

You will be graded on...

Quizzes

There will be a quiz in each of the first four modules. The primary goal of quizzes is to encourage students to keep current with the course material. Each quiz is graded for 100 points.

Programming Assignments

Students are expected to program the assignments on their own using the respective technologies. Each assignment is graded for 100 points based on the completeness and the programming style. There will be six assignments in total, one for each module.

Term Project

There will be a Term Project for this course. See the Term Project description to familiarize with the project requirements and expectations.

Final Exam

There will be a proctored Final Exam for this course.

Late Submission Policy

Students are expected to submit all assignments by the deadlines established in the Syllabus and Study Guide. All times referenced in this course (unless otherwise specified) are in Eastern Time. If you anticipate being unable to meet a deadline, you must contact the instructor *in advance* with

relevant details. Late submissions will *not* be accepted or graded. Extensions may be considered *only under extenuating circumstances* and must be approved in advance by the instructor.

Policy for the Use of Generative AI

Students should learn how to use AI text generators and other AI-based assistive resources (collectively, AI tools) to enhance rather than damage their developing abilities as writers, coders, communicators, and thinkers.

When using Generative AI in coursework, students shall:

1. Give credit to AI tools whenever used, even if only to generate ideas rather than usable text or illustrations.
2. When using AI tools on assignments, add an appendix showing (a) the entire exchange, highlighting the most relevant sections; (b) a description of precisely which AI tools were used (e.g. ChatGPT private subscription version or DALL-E free version), (c) an explanation of how the AI tools were used (e.g. to generate ideas, turns of phrase, elements of text, long stretches of text, lines of argument, pieces of evidence, maps of conceptual territory, illustrations of key concepts, etc.); (d) an account of why AI tools were used (e.g. to save time, to surmount writer's block, to stimulate thinking, to handle mounting stress, to clarify prose, to translate text, to experiment for fun, etc.).
3. Not use AI tools during in-class examinations, or assignments, unless explicitly permitted and instructed.
4. Employ AI detection tools and originality checks prior to submission, ensuring that their submitted work is not mistakenly flagged.
5. Use AI tools wisely and intelligently, aiming to deepen understanding of subject matter and to support learning.

For more details, please see the Generative AI Assistance (GAIA) policy (https://www.bu.edu/cds-faculty/culture-community/gaia-policy/).

Academic Conduct Policy

Academic Integrity: Plagiarism is the passing off of another's words or ideas as your own, and it is a serious academic offense. Plagiarism and cheating also defeat the purpose of getting an education. Plagiarism and cheating cases will be handled in accordance with the disciplinary procedures described in the College of Arts and Sciences Academic Conduct Code. You are expected to know and abide by the code, which can be read online: Academic Conduct Code (https://www.bu.edu/academics/policies/academic-conduct-code/). Penalties range from failing an assignment or course (first offense) to suspension or expulsion from BU. If in doubt, cite your source. If you have any questions about academic integrity, please ask your instructor.

Incidents of academic misconduct will be reported to the Academic Conduct Committee (ACC). The ACC may suspend/expel students found guilty of misconduct.

Disability and Access Services

In accordance with University policy, every effort will be made to accommodate students with respect to speech, hearing, vision, or other disabilities. Any student who may need an accommodation for a documented disability should contact Disability and Access Services (http://www.bu.edu/disability) at 617-353-3658 or at access@bu.edu (mailto:access@bu.edu) for review and approval of accommodation requests.

Once a student receives their accommodation letter, they must send it to their instructor and/or facilitator each semester. They must also send a copy to their Faculty & Student Support Administrator, who may need to update the course settings to ensure accommodations are in place. Accommodations cannot be implemented if the student does not send their letter.