

Statistics
Course Number: 26:960:670
Course Title: Multivariate Analysis

COURSE DESCRIPTION

Outcomes are typically an output of multiple interactions. As companies generate and store data, it is becoming increasingly necessary to leverage this data for data driven decision making. Although companies have access to the tools and data, they lack human capital with the knowledge to analyze this data to enable competitive business outcomes. Multivariate Statistical techniques are important tools of analysis in all fields of management. This course is designed to provide students with a working knowledge of the concepts underlying the most important multivariate techniques. It will provide an overview of actual applications in various fields. It will equip students to understand the best technique given their business problem. They will gain experience in using such techniques on a problem of their own choosing. The course will address both the underlying mathematics and problems of applications. As such, a reasonable level of competence in both statistics and mathematics is needed. The overall objective of this course is to introduce students to both technical and managerial issues and implications for multivariate analysis. Lectures will be complemented by laboratory exercises to expose students to practical applications of these concepts and technologies. The analysis process includes data selection, selecting the appropriate mathematical and/or statistical method, and reporting and visualization of the insights. The course will cover all these issues and will illustrate the whole process by examples of practical applications. Course material will be placed on the course website. The address and access rules of this site will be announced during the first lecture.

Learning Management System: Canvas

COURSE MATERIALS

- Textbook(s): [Optional]. An Introduction to Applied Multivariate Analysis with R by Brian Everitt & Torsten Hothorn

LEARNING GOALS AND OBJECTIVES

- This course is designed to help students develop skills and knowledge in the following area(s):

Business knowledge. Students will have a command of business theory and practice in the field of multivariate analysis.

Students who complete this course will demonstrate:

- a) To understand the main features of multivariate data
- b) To be able to use exploratory and confirmatory multivariate statistical methods properly.
- c) To be able to carry out multivariate statistical techniques and methods efficiently and effectively.

Ethical Judgement. Students will use reasoned and ethical judgment when analyzing problems and making decisions.

Students who complete this course will demonstrate:

- d) Recognition of ethical dilemmas in working with data.
- e) To critically evaluate business analysis scenarios with multiple variables and develop innovative and ethical solutions

Critical Thinking Skills Students will be able to understand complex business situations and provide solutions to improve current business practices.

Students who complete this course will demonstrate:

- f) Ability to identify problems in a situation.
- g) Ability to find innovative solutions.

Persuasive communication. Students will be effective communicators.

Students who complete this course will demonstrate:

- h) Ability to construct clear, concise, and convincing written business communication.
- i) Ability to construct and deliver clear, concise, and convincing oral business communication.

Students develop these skills and knowledge through the following course activities and assignments:

- Lectures. Besides delivering basic concepts, technology, and processes followed in data analytics, the lectures focus on various business application areas, such as finance, marketing, sales, and inventory, and explain how analytics problems can be formulated and solved.
- Labs. Several required labs in R will be assigned in this class for students to acquire experience in using analytics software that can be applied in future coursework and career. Each lab will deal with one or more functional areas in real business and require the use of data analytics technologies

- Homework and Exams. Basic data analytics concepts will be tested, and several data analytics implementation cases will be studied for students to gain some experience on real business problems.

After completing the course, students will be able to:

- Explore and summarize multivariate data using graphical and numerical methods and techniques to uncover hidden information and patterns.
- Describe properties of multivariate distributions such as multivariate normal.
- Use principal component analysis effectively for data exploration and data dimension reduction.
- Use factor analysis effectively for exploratory and confirmatory data analysis.
- Discriminate between groups and classify new observations.
- Find groupings and associations using cluster and correspondence analysis.
- Master the ability to analyze, model, visualize, and communicate using R

PREREQUISITES

- Basic Knowledge of Statistics
- Basic Knowledge of Excel
- Basic Knowledge of R

ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy <http://academicintegrity.rutgers.edu/>

I will strongly enforce this Policy and pursue *all* violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, “On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment.” I will screen all written assignments through *SafeAssign* or *Turnitin*, plagiarism detection services that compare the work against a large database of past work. Don’t let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND PREPARATION POLICY

- Expect me to attend all class sessions. I expect the same of you. If I am to be absent, my department chair or I will send you notice via email and Canvas as far in advance as possible. If you are to be absent, report your absence in advance at <https://sims.rutgers.edu/ssra/>. If your absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death and you seek makeup work, also send [me/TA] an email with full details and supporting documentation within 2 days of your first absence.

- Expect me to arrive on time for each class session. I expect the same of you.
- Expect me to remain for the entirety of each class session. I expect the same of you.
- Expect me to prepare properly for each class session. I expect the same of you. Complete all background reading and assignments. You cannot learn if you are not prepared. The minimum expectation is that for each 3-hour class session, you have prepared by studying for at least twice as many hours.
- Expect me to participate fully in each class session. I expect the same of you. Stay focused and involved. You cannot learn if you are not paying attention.

CLASSROOM CONDUCT

- There will be no cold calling. All participation is voluntary-Intention to contribute to the class discussion should be flagged by hand-raising
- Cell phones usage is not permitted in the class except for emergencies
- Food & drink are permitted
- Side conversations are not permitted during lecture

EXAM DATES AND POLICIES

Course grades are determined as follows:

There are 2 exams in this course, their dates will be announced at least 2 weeks in advance. Tentative dates will be given on the course website at Week 1.

-Midterm Exam

-Final Exam

Assessment:

Midterm Exam 20%

Final Exam 35%

Home Work 25%

Class Attendance/Participation 20%

The final grade will be based on the class curve, which will depend on the overall class performance. However, the tentative necessary conditions of score intervals for grades are as follows (before class participation score is added):

-A, A-: upper 90% -95% (tentative curve: A upper half, A-lower half in this interval)

-B+, B, B-:75% -89% (tentative curve: B+ upper, B middle and B-lower third in this interval)

-C+, C, C-: 60% -74% (tentative curve: C+ upper, C middle and C-lower third in this interval)

-D: 50% -59%

-F: below 49%

Please note that this grade scheme is tentative, and the final grading scheme will be based on the scores distribution after the final exam.

There will be no extra credit assignments, quizzes, or exams. Therefore, please plan to put in your best effort right from the start. Your final grade is not subject to negotiation. If you feel I have made an error, submit your written argument to me within one week of receiving your final grade. Clarify the precise error I made and provide all due supporting documentation. If I have made an error, I will gladly correct it. I cannot and will not adjust grades based on consequences, such as hurt pride, lost scholarships, lost tuition reimbursement, lost job opportunities, or dismissals. Do not ask me to do so. It is dishonest to attempt to influence faculty to obtain a grade that you did not earn.

The grades for all assessment components will be posted at the canvas's grade center after they are marked.

COURSE SCHEDULE

Session: Topic

1: Multivariate Data &Multivariate Statistics

2: Exploring Multivariate Data Graphically

3:Principal Components Analysis

4: Correspondence Analysis

5: Multidimensional Scaling

6: Cluster Analysis

- 7: Midterm Exam
- 8: Generalized Linear Models
- 9: Regression and MANOVA
- 10: Log-Linear and Logistic Models
- 11: Multivariate Response Models
- 12: Discrimination, Classification, and Pattern Recognition
- 13: Exploratory Factor Analysis
- 14: Final Exam

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. More information can be found at ods.rutgers.edu.

[Rutgers University-New Brunswick ODS phone (848)445-6800 or email dsoffice@echo.rutgers.edu]

[Rutgers University-Newark ODS phone (973)353-5375 or email ods@newark.rutgers.edu]

If you are *pregnant*, the Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy.

[Rutgers University-New Brunswick Title IX Coordinator phone (848)932-8200 or email jackie.moran@rutgers.edu]

[Rutgers University-Newark Office of Title IX and ADA Compliance phone (973)353-1906 or email TitleIX@newark.rutgers.edu]

If you seek *religious accommodations*, the Office of the Dean of Students is available to verify absences for religious observance, as needed.

[Rutgers University-New Brunswick Dean of Students phone (848)932-2300 or email deanofstudents@echo.rutgers.edu]

[Rutgers University-Newark Dean of Students phone (973)353-5063 or email DeanofStudents@newark.rutgers.edu]

If you have experienced any form of *gender or sex-based discrimination or harassment*, including sexual assault, sexual harassment, relationship violence, or stalking, the Office for Violence Prevention and Victim Assistance provides help and support. More information can be found at <http://vpva.rutgers.edu/>.

[Rutgers University-New Brunswick incident report link: <http://studentconduct.rutgers.edu/concern/>. You may contact the Office for Violence Prevention and Victim Assistance at (848)932-1181]

[Rutgers University-Newark incident report link: https://cm.maxient.com/reportingform.php?RutgersUniv&layout_id=7 . You may also contact the Office of Title IX and ADA Compliance at (973)353-1906 or email at TitleIX@newark.rutgers.edu. If you wish to speak with a staff member who is confidential and does **not** have a reporting responsibility, you may contact the Office for Violence Prevention and Victim Assistance at (973)353-1918 or email run.vpva@rutgers.edu]

If students who have experienced a temporary condition or injury that is adversely affecting their ability to fully participate, you should submit a request via <https://temporaryconditions.rutgers.edu> .

If you are a military *veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of *mental health* services, please use our readily available services.

[Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>]

[Rutgers Counseling and Psychological Services–New Brunswick: <http://rhscaps.rutgers.edu/>]

If you are in need of *physical health* services, please use our readily available services.

[Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>]

[Rutgers Health Services – New Brunswick: <http://health.rutgers.edu/>]

If you are in need of *legal* services, please use our readily available services: <http://rusls.rutgers.edu/>

Students experiencing difficulty in courses due to *English as a second language (ESL)* should contact the Program in American Language Studies for supports.

[Rutgers–Newark: PALS@newark.rutgers.edu]

[Rutgers–New Brunswick: eslpals@english.rutgers.edu]

If you are in need of additional *academic assistance*, please use our readily available services.

[Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>]

[Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>]

[Rutgers University-New Brunswick Learning Center: <https://rlc.rutgers.edu/>]

[Optional items that many faculty include:

- Students must sign, date, and return a statement declaring that they understand the RU Academic Integrity Policy.
- Students must sign, date, and return a statement declaring that they understand this syllabus.]