IE 1071: Statistical Testing and Regression

Spring, 2020-2021

Class Room: Room **A210** Shuiming Building

Class Hours: Wednesday 3:40-4:35 pm, 4:45-5:30 pm, 5:40-6:25 pm

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Office Hours: Tue./Fri. 10:15-11:00 am, Tue./Thur./Fri. 1:30-5:30 pm, or by appointments

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Tutorials: Room **4-201** Friday 3-5 pm

Course Description

The topics discussed are of great importance to any student majoring in industrial engineering. Topics include hypothesis testing, analysis of variance (ANOVA), linear regression, categorical data analysis (*e.g*, contingency tables, loglinear models, logistic regressions and goodness of fit), and nonparametric statistics.

Prerequisites

IE 1070 Probability and Statistics for Engineers 1

Course Objectives

The main objective of this course is to provide a solid practical grounding in statistical tests and data analysis as well as other fundamental statistical methods that one will encounter in industrial engineering. At the completion of this course, students are expected to

1. Have a solid understanding of one- and two-sample tests of hypotheses.
2. Know regression methods for both simple linear regression and multiple linear regression as well as certain nonlinear regression models.
3. Understand one-way and two-way analysis of variance (ANOVA) thoroughly.
4. Gain experience in non-parametric tests.
5. Solve certain statistical problems employing R programming.

Course Content

We will cover most of the material from Chapters 9-14 & 16 in the textbook.

Class Structure

Lectures. We will have quizzes or class activities in each class.

Course Materials

Textbook: Probability and Statistics for Engineering and the Sciences, 9th Edition, Pearson, by Walpole, Myers, Myers and Ye.

Suggested Reading: R programming Manuals can be found at https://cran.r-project.org/doc/manuals/. You may find *R-intro.pdf* and *R-data.pdf* useful.

Software Requirements

We will use **R programming** for this course. R is an open-source software and its most up-to-date version can be downloaded from https://cran.r-project.org/bin/windows/base/ for Windows, and https://cran.r-project.org/bin/macosx/ for Mac OS. Afterwards, please also download and install **RStudio Desktop**, which is a powerful and free interface of R, from https://rstudio.com/products/rstudio/download/.

Blackboard

Please regularly log on and check https://learn.scupi.cn/. We will post lecture notes, assignments, projects, announcements and your grades on it.

Course Assessment

Weekly assignments, quizzes, class activities, projects, midterm and final exams.

Schedule of Exams, Assignments and Projects

Exams

Date	Time	Component
April 29, 2021 (2 hours in class)	4:30-6:30 pm	Midterm
Final exam week (June 26 to July 2)	TBA	Final exam

Assignments

Homework assignments will be given out weekly. They will be due by the following week on Wednesday at the beginning of the class at 3:40 pm. Plagiarism will not be tolerated. However, discussions of assignment problems will be permitted. Please also note each student must submit his/her individual assignment.

Projects

Students will work in small groups of 4-5 students on each project. It is the responsibility of the groups to manage their own interactions and individual participation. Starting in Week 04, each group will be asked to consult TA for your Project 1, and a completed report for Project 1 is expected by May 5. The groups will make a professional-level presentation for Project 2 during Weeks 14 and 15. Each student in a group will receive the same grade based on the assessment of the project written report and presentation.

Start	Due	Component
March 31, 2021	May 5, 2021	Project 1
May 5, 2021	June 2, 2021	Project 2

Quizzes

Students will be asked to complete a quiz in each class. Normally, a quiz consists of a short-answer question.

Grading Policy

The final grade be computed according to the following scheme:

Scheme: Total grade = 20% Assignments + 20 % Midterm Exam + 30 % Final Exam + 20 % Projects + 10 % Quizzes, Class Activities and Attendance.
Note: All midterm and final exams will be closed-book.

Conversion of Numerical Grades to Final Letter Grades Follows the SCUPI Common Grade

A $[90, 100]$ A- $[85, 90)$ B+ $[80, 85)$ B $[76, 80)$ B- $[73, 76)$ C+ $[70, 73)$ C $[66, 70)$
C- $[63, 66)$ D+ $[61, 63)$ D $[60, 61)$ F $(60, 0)$

Schedule and weekly learning goals

The schedule is tentative and subject to change. The listed objects below should be viewed as the key concepts you should grasp after each week, and also as a study guide before each exam, and at the end of the semester. The midterm exam will test on the material that was taught up until week prior to the exam, that is, Weeks 01-08 (excluding multiple linear regression). The final exam will cover all topics taught in this semester.

Week 01, 03/08-03/12

- Review Chapter 8, Overview and Introduction of R programming.
- Random sampling, Sampling distributions of the mean and the sample variance.
- Quantile and probability plots.

Week 02, 03/15-03/19

- Review Sections 9.1-9.9.
- One- and two-sample problems: point estimation and interval estimation.
- Estimating the mean: single sample and two samples, confidence intervals, prediction intervals and tolerance intervals.

Week 03, 03/22-03/26

- Review Sections 9.10-9.15.
- Estimating a proportion: single sample and two samples.
- Estimating the variance: single sample and two samples.

Week 04, 03/29-04/02

- Cover Sections 10.1-10.7.
- Hypothesis tests for means. P-values in testing hypothesis.

Week 05, 04/05-04/09

- Cover Sections 10.8-10.15.
- Hypothesis tests for proportions.
- Categorical data analysis: the χ^2 goodness of fit test, the χ^2 test for independence and homogeneity.

Week 06, 04/12-04/16

- Cover Sections 11.1-11.9.
- Linear regression analysis.

Week 07, 04/19-04/23

- Cover Sections 11.10-11.13 & 12.1-12.5.
- Transformations, correlation and multiple linear regression.

Week 08, 04/26-04/30 Midterm

- Cover Sections 12.6-12.12.
- Multiple linear regression analysis and certain nonlinear regression models.

Week 09, 05/03-05/07

- Section 12.13. Summary of multiple linear regression.

- Midterm.

Week 10, 05/10-05/14

- Cover Sections 13.1-13.6.
- One-way ANOVA.

Week 11, 05/17-05/21

- Cover Sections 13.6-13.13.
- Blocking and graphical methods.

Week 12, 05/24-05/28

- Cover Chapter 14.
- Factorial experiments (two or more factors).

Week 13, 05/31-06/04

- Cover Chapter 16.
- Nonparametric statistics.

Week 14, 06/07-06/11

- Project presentations.

Week 15, 06/14-06/18

- Project presentations.

Week 16, 06/21-06/25 Review session
Week 17, 06/26-07/02 Final Exam Week

Course Policies

There will be no special treatments for any students in this course! For example, if you have a heavy course load, you should expect a steep learning curve and be prepared for it. You will not be exempted from any assignments.

During Class

I understand that the electronic recording of notes will be important for class and so computers will be allowed in class. Please refrain from using computers for anything but activities related to the class. Phones are prohibited as they are rarely useful for anything in the course. Eating and drinking are allowed in class but please refrain from it affecting the course. Try not to eat your lunch in class as the classes are typically active.

Attendance Policy

Attendance is expected in all lectures. Valid excuses for absence will be accepted before class. In extenuating circumstances, valid excuses with proof will be accepted after class.

Policies on Late Assignments and Exams

Students should start their homework assignments immediately after the assignments are given, and DO NOT wait until the last minute to meet the deadlines. Late assignments will be NOT accepted except for emergencies and health issues. Any other late assignments handed in will be marked but will be given 0. At most **Two** extensions for assignments will be given in this course. All assignments will be counted in your total grade.

All midterm and final exams are mandatory. There will be absolutely no makeup exam for the midterm. If you miss the final, a makeup exam may be given for the final exam if the student has the approval from the instructor or emergencies and health issues **with a valid proof**. I will not accept the student deceleration for absence form for the final exam.

Academic Integrity

At Sichuan University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do.

Everyone at SCUPI is expected to treat others with dignity and respect. The Code of Student Conduct allows Sichuan University to take disciplinary action if students don't follow this community expectation.