# Applied Statistics for Analytics

ITP 251 (2 Units)

USC Viterbi School of Engineering

## Course Description

With the staggering growth in the sheer volume of digital data, quantitative reasoning has become crucial in our "Big Data" world. This course provides an introduction to core statistical methodologies critical for understanding this world. It focuses on introducing concepts through practical applications and analyses of real data.

## Objectives

The primary goal of this course is to teach students how to methodically pose questions, collect relevant data, analyze data, interpret data and provide insights.

## Prerequisites

None

## Lectures

Mondays and Wednesdays 2:00 PM to 3:20 PM in WPH 102

## Instructor

Arpi Mardirossian
Email: mardiros@usc.edu
Blue Jeans: bluejeans.com/mardiros
Office Hours: Mondays and Wednesdays 1:00 PM to 2:00 PM in OHE 530C or BlueJeans

## Teaching Assistant

TBD

## Grading

The weight of the graded material during the semester is listed below:

| | |
|---|---|
| Homework | 30% |
| Quizzes | 10% |
| Midterm Exam | 30% |
| Final Exam | 30% |

## Website

blackboard.usc.edu

## Required Textbook

Stine, Robert A. and Foster, Dean (2014). *Statistics for Business: Decision Making and Analysis* (2nd Edition). Pearson Education. ISBN 0321890590.

## Course Outline

**Week 1 (01.09)** – Introduction
- What is statistics?
- *Reading Assignment*: Chapter 1

**Week 1 (01.11)** – Data
- Categorical and numerical data
- Recording and aggregation
- Time series
- *Reading Assignment*: Chapter 2

**Week 2 (01.16)**
*Martin Luther King Day*

**Week 2 (01.18)** – Categorical data
- Looking at data
- Charts
- Area principle
- Mode and median
- *Reading Assignment*: Chapter 3

**Week 3 (01.23)** – Categorical variables
- Contingency tables
- Lurking variables
- Strength of association
- *Reading Assignment*: Chapter 5

**Week 3 (01.25)** – Numerical data
- Numerical variables
- Histograms
- Boxplots
- Distribution shapes
- *Reading Assignment*: Chapter 4

**Week 4 (01.30)** – Numerical variables
- Scatterplots
- Measuring association
- Correlation
- *Reading Assignment*: Chapter 6

**Week 4 (02.01)** – Probability
- From data to probability

- Probability rules
- Independent events
- *Reading Assignment*: Chapter 7
- **Quiz**

**Week 5 (02.06)** – Conditional probability
- From tables to probabilities
- Dependent events
- Organizing probabilities
- Order
- *Reading Assignment*: Chapter 8

**Week 5 (02.08)** – Random variables
- Properties of random variables
- Expected values
- Comparing random variables
- *Reading Assignment*: Chapter 9

**Week 6 (02.13)** – Random variable association
- Joint probability distribution
- Sums of random variables
- Dependence of random variables
- Weighted sums
- *Reading Assignment*: Chapter 10

**Week 6 (02.15)** – Probability models
- Random variables
- Binomial model
- Poisson model
- *Reading Assignment*: Chapter 11

**Week 7 (02.20)**
*Presidents' Day*

**Week 7 (02.22)** – Normal probability model
- Normal random variable
- Normal model
- Percentiles
- *Reading Assignment*: Chapter 12

**Week 8 (02.27)** – Midterm Review

**Week 8 (03.01)** – **Midterm Exam**

**Week 9 (03.06)** – Samples
- Sampling methods
- Variation

- Questions to ask
- *Reading Assignment*: Chapter 13

**Week 9 (03.08)** – Confidence intervals
- Ranges
- Confidence interval for the mean
- Interpretation
- Manipulation
- Margin of error
- *Reading Assignment*: Chapter 15
- **Quiz**

**Week 10 (03.13)**
*Spring Recess*

**Week 10 (03.15)**
Spring Recess

**Week 11 (03.20)** – Statistical tests
- Concepts of testing
- Testing the proportion and mean
- Significance versus importance
- *Reading Assignment*: Chapter 16

**Week 11 (03.22)** – Comparison
- Z-tests
- Confidence intervals
- T-tests
- *Reading Assignment*: Chapter 17

**Week 12 (03.27)** – Inference for counts
- Chi-squared tests
- Test of independence
- Hypotheses
- Goodness of fit test
- *Reading Assignment*: Chapter 18

**Week 12 (03.29)** – Linear patterns
- Fitting a line
- Residuals
- Variation
- *Reading Assignment*: Chapter 19

**Week 13 (04.03)** – Curved patterns
- Detecting nonlinear patterns
- Transformation

- *Reading Assignment*: Chapter 20
- **Quiz**

**Week 13 (04.05)** – Regression model
- Simple regression model
- Inference in regression
- Prediction intervals
- *Reading Assignment*: Chapter 21

**Week 14 (04.10)** – Regression diagnostics
- Changing variation
- Outliers
- Dependent errors
- *Reading Assignment*: Chapter 22

**Week 14 (04.12)** – Multiple regression
- Interpreting multiple regression
- Checking conditions
- Inference
- Fitting
- *Reading Assignment*: Chapter 23

**Week 15 (04.17)** – Building regression models
- Explanatory variables
- Collinearity
- *Reading Assignment*: Chapter 24

**Week 15 (04.19)** – Explanatory variables
- Two-sample comparisons
- Covariance
- Checking conditions
- Interactions and inference
- *Reading Assignment*: Chapter 25

**Week 16 (04.24)** – Analysis of variance
- Comparing groups
- Anova
- *Reading Assignment*: Chapter 26
- **Quiz**

**Week 16 (04.26)** – Final Review

**Finals Week (05.03 – 05.10)** – **Final Exam**

## Policies

**Exams**

- You will be permitted to bring a calculator. You will not be permitted to share a calculator with someone else.
- You will be permitted to bring one 8.5 x 11 cheat sheet.
- You will not be permitted to bring a laptop computer.
- You will not be permitted to use any mobile devices.
- No make-up exams (except for documented medical or family emergencies) will be offered nor will there be any changes made to the Final Exam schedule, except as permitted by university rules.

**Quizzes**

- You will be permitted to bring a calculator. You will not be permitted to share a calculator with someone else.
- You will not be permitted to bring a laptop computer.
- You will not be permitted to use any mobile devices.
- No make-up quizzes (except for documented medical or family emergencies) will be offered.

**Homework**

- You are encouraged to work with your classmates. However, each student must turn in their own copy of the homework.
- Late homework submissions will be subject to a late penalty. No assignments will be accepted later than five days from the due date.

## Incomplete and Missing Grades

Excerpts for this section have been taken from the University Grading Handbook, located at http://www.usc.edu/dept/ARR/grades/gradinghandbook/index.html. Please see the link for more details on this and any other grading concerns.

A grade of Missing Grade (MG) "should only be assigned in unique or unusual situations… for those cases in which a student does not complete work for the course before the semester ends. All missing grades must be resolved by the instructor through the Correction of Grade Process. One calendar year is allowed to resolve a MG. If an MG is not resolved [within] one year the grade is changed to [Unofficial Withdrawal] UW and will be calculated into the grade point average a zero grade points.

A grade of Incomplete (IN) "is assigned when work is no completed because of documented illness or other 'emergency' **occurring after the twelfth week** of the semester (or 12$^{th}$ week equivalency for any course scheduled for less than 15 weeks)."

## Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to your course

instructor (or TA) as early in the semester as possible. If you need accommodations for an exam, the form needs to be given to the instructor at least two weeks before the exam.

DSP is located in STU 301 and is open from 8:30am to 5:00pm, Monday through Friday. Contact info: 213-740-0776 (Phone), 213-740-6948 (TDD only), 213-740-8216 (FAX), ability@usc.edu, http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html.

## Emergency Preparedness / Course Continuity in a Crisis

In case of emergency, when travel to campus is difficult, if not impossible, USC executive leadership will announce a digital way for instructors to teach students in their residence halls or homes using a combination of the Blackboard LMS (Learning Management System), teleconferencing, and other technologies. Instructors should be prepared to assign students a "Plan B" assignment that can be completed 'at a distance.' For additional information about maintaining your classes in an emergency, please access:
http://cst.usc.edu/services/emergencyprep.html.

## Academic Conduct

Each student is expected to: be responsible for his/her own learning, to solve and write up his/her own solutions, and, to credit all sources of material and collaborators to the formulating of a solution. Plagiarism, the use and passing off of the ideas or work of another as one's own, will be severely punished; see USC's Academic Integrity Policy:

*You are expected to solve and write up your own homework, or you will be penalized for cheating. But you are encouraged to study and to work on assignments and homework together. This includes discussing solution strategies to be used on individual assignments. If you do study or work together on homework, be sure to credit your team of collaborators. However, all work submitted for the class is to be done individually.*

*All USC students are responsible for reading and following the Student Conduct Code. The USC Student Conduct Code prohibits plagiarism. Some examples of what is not allowed by the conduct code: copying all or part of someone else's work (by hand or by looking at others' files, either secretly or if shown), and submitting it as your own; giving another student in the class a copy of your assignment solution; consulting with another student during an exam. If you have questions about what is allowed, please discuss it with the instructor.*

*Students who violate University standards of academic integrity are subject to disciplinary sanctions, including failure in the course and suspension from the University. Since dishonesty in any form harms the individual, other students, and the University, policies on academic integrity will be strictly enforced. Violations of the Student Conduct Code will be filed with the Office of Student Conduct, and appropriate sanctions will be given.*

Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating- university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

## Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* *http://emergency.usc.edu/* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.