

B6100 Managerial Statistics Fall (A) 2017

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Office Hours: Tuesdays 6-7 pm, or by appointment

(Please email professor directly, not through Canvas)

Teaching Assistants: TBA

Students should check Canvas regularly for course announcements and updates.

COURSE DESCRIPTION

A career in management is likely to involve decision making based on data. Recent advances in computing and technology in general have made an abundance of information readily available to be exploited as part of a decision making process; the so-called Big Data revolution. The main objective of this course is to provide an understanding of basic statistical concepts and tools, and their use in making business decisions. Examples of questions that can be addressed with the aid of statistical analysis include *estimating* product reliability, *testing* investment strategies, testing for *bias* in analysts' recommendations, and *predicting* a product's sales on the basis of its characteristics.

The course will cover the following key concepts:

- *Descriptive statistics* deals with summarizing data, observing patterns in it, and extracting the vital information contained in it.
- *Probability* concepts, such as expected value, variance and covariance, provide a systematic framework for modeling uncertainty and salient features of the data generating process.
- *Sampling* and *Estimation* theory concerns the use of sample data (e.g. surveys/polls) to make inferences, quantify uncertainty, and test hypotheses we are entertaining about the underlying data generating mechanism.
- *Regression* analysis deals with the construction of predictive models based on data. We will focus on linear regression with emphasis on model fitting, significance testing and prediction assessment.

CLASSROOM NORMS AND EXPECTATIONS

Students are expected to adhere to CBS Core Culture in this class by being Present, Prepared, and Participating.

Class contribution points amount to actively working toward a constructive learning environment. This means adhering to the core culture and, more broadly, being engaged and respectful. Class contribution **does not** grade you on providing correct (or incorrect) answers to questions raised in class, nor should anyone feel obligated to raise points and discussion items merely for the sake of participation credit.

Please note that laptops, tablets and phones are not to be used in this class.

REQUIRED COURSE MATERIALS

There is no required textbook for this course.

Prior to the start of the course, students are asked to review a few short videos (available on the course website) that cover some introductory material on data analysis.

Lecture slides will be provided in class and through the course website and will cover all material discussed in class. The course pack, titled *Readings & Cases*, contains more comprehensive notes to supplement the slides; see part A titled “Course Notes.” Part B of the *Readings & Cases* contains a set of problems along with solutions. Working through these problems is the best way to master the material covered in class and prepare for the exams. These problems are meant for self-study and will not be collected or graded. They will also be discussed in weekly review sessions led by teaching assistants. Part C of the course pack contains a few articles of interest and some of the cases covered in class.

For students seeking an additional resource, the text below will be available on reserve in the library.

Levine, Stephan, Krehbiel, & Berenson *Statistics for Managers*, 6th Ed., Prentice-Hall 2010.

It also contains a host of supplementary problems for self-practice, a select subset along with complete solutions will be posted on the course website. These problems will not be collected or graded.

COURSE ROADMAP

(1) Descriptive statistics: frequency distribution; mean, median and mode; percentiles; sample variance and standard deviation; normal approximation; a prelude to regression. 2 sessions. [CN: Section 1, LSKB: Chapters 2 and 3.]

(2) Modeling uncertainty: definition and basic properties of random variables; probability distributions; expected value and variance; transformations of random variables; normal distribution. 3 sessions. [CN: Section 3 and 4 (optional reading, Section 2), LSKB: Chapters 4, 5 and 6.]

(3) Sampling and Estimation: random sampling; polls; types of samples; distribution of sample estimates; point estimates; accuracy and precision; bias; constructing confidence intervals; statistical significance and p-values. 4 sessions. (CN: Sections 5 and 6, LSKB: Chapters 7, 8 and 9.)

(4) Regression: simple linear regression; estimation of parameters and significance testing; correlation coefficient; interpreting the regression output; multiple linear regression; dummy variables; model selection; examples of non-linear regression; applications. 5 sessions. (CN; Section 7, LSKB: Chapters 13, 14 and 15.)

LSKB refers to the text by Levine, Stephan, Krehbiel, & Berenson, which, as stated earlier, is an optional reference text, and on reserve in the library.

CN refers to the “Course Notes,” part A of the Cases & Readings course pack.

Textbook readings are from Levine, Stephan, Krehbiel, and Berenson (LSKB).

COURSE SCHEDULE

Session	Date	Topic(s)	Optional Readings	Due that day (group/individ.)
MODULE 1: Descriptive Statistics (Course Notes: Descriptive Statistics, LSKB: 3.1-3.3)				
1	Th 9/7/17	Introduction and course overview; recap of descriptive statistics material (mean, median, standard deviation, Normal approximation, Value-at-Risk)		
2	Fri 9/8/16	Normal approximation; financial data; skewness and kurtosis; correlation; regression line		
MODULE 2: Probability and modeling uncertainty (Course Notes: Random Variables and their Distributions, and Normal Distribution)				
3	Tu 9/12/17	Random variables; expected value; variance	LSKB: 3.5	
4	Th 9/14/17	Normal distribution, standardization	LSKB: 6.1-6.2	HW #1 - group
5	Fri 9/15/17	How correlation affects variance; applications to hedging and portfolio selection		
<i>The case "Gotham Bank Investment Services" in your casebook is good reading after that session. You do not need to prepare answers to the questions at the end of the case.</i>				
MODULE 3: Sampling and Estimation (Course Notes: Sampling Distributions, Estimation and Confidence Intervals, and Statistical Significance [pp. 85-91 from Appendix on Hypothesis Testing])				
6	Tu 9/19/17	Sampling and standard error	LSKB: 7.1-7.4	
7	Th 9/21/17	Standard error, margin of error, confidence level; polls	LSKB: 7.5	HW #2: Variance Associates - group
8	Fri 9/22/17	MIDTERM EXAM		
9	Tu 9/26/17	Confidence intervals for mean and proportion; Student t distribution	LSKB: 8.1-8.4.	
10	Th 9/28/17	Statistical significance; testing for significance		

MODULE 4: LINEAR REGRESSION (Course Notes: Linear regression)				
11	Fri 9/29/17	Basic concepts of regression; fitting a line to data; least squares	LSKB: 13.1-13.4	
12	Tu 10/3/17	Goodness of fit; p-values; interpreting regression output	LSKB: 13.7-13.8, 14.1-14.4, 14.6, 15.3	HW #3: Analyzing the Analysts - group
13	Th 10/5/17	Model building; estimation of a demand model based on sales data		
<p><i>In preparation for session 13, please download the file airline-data.xlsx and run linear regressions to estimate the business and youth demand functions. The data file is related but is not identical to the one you studied in your Managerial Economics class in the context of the Airline Pricing on Shuttle Routes case. Please be prepared to discuss your findings. Having a short printout of the two regression outputs would be helpful.</i></p>				
14	Tu 10/10/17	Applications 1: from linear to non-linear regression (All-around movers)	LSKB: 15.2-15.3	
15	Th 10/12/17	Applications 2: Capital Asset Pricing Model (CAPM); course recap		HW #4: Pricing Diamonds - group
<p><i>In your Corporate Finance course, you have been discussing the CAPM in sessions 11-12, where you covered the underpinnings of the model and its main findings and introduced the concept of beta of a stock.</i></p> <p><i>As part of an application of linear regression in that context, I want you to download WeeklyData-20112013>Returns.xlsx and run pairwise regressions between each stock and the market return, and between the equal weight portfolio and the market return. The file contains price data and also weekly returns (in the "weekly returns" tab) from Jan 2011 to Sept 2013 for XOM, IBM, JPM, CSCO and the equal weight portfolio. Please come prepared to briefly discuss your regression results.</i></p>				

METHOD OF EVALUATION

We will have a midterm and a final exam. Exams will be closed book. However, students may bring three sheets of notes to each exam (where you may write on both sides of each sheet).

Grades will be based on the maximum of the following two weighting schemes:

#1: Class contribution 5%; Hand-in assignments 20%; Midterm 30%; Final 45%

#2: Class contribution 5%; Hand-in assignments 20%; Midterm 0%; Final 75%

More specifically, cumulative scores will be computed based on both schemes and the greater of the two will be used to determine the score of each student. This scheme makes it possible to fully recover from a weak score on the midterm.

NOTICE: All requests for reconsideration of assignment or exam scores and requests to take exams at other than the scheduled times, must be made in writing.

ASSIGNMENTS

It is highly recommended to work through the problems in part B of the course pack on a weekly basis; students should consider this as informal self-study homework. In addition to these exercises, there will be **four hand-in assignments** during the course that will be graded. **These assignments are of type 'A'** (see table below), so group work is permitted (and encouraged). Each group submits a single solution write-up, and all members of the group will receive the same grade. **Maximal group size is limited to six students**; assignments submitted with four or more names will not receive credit.

All of your assignment submissions are subject to the [CBS Honor Code](#). Violations of the CBS Honor Code may lead to failing the assignment, failing the course, suspension, and/or dismissal. In order to avoid ambiguity that may lead to unintentional violations of the Honor Code, assignment description types have been standardized and specified below.

<u>Type</u>	<u>Designation</u>	<u>Grade</u>	<u>Preparation of submission</u>	<u>Discussion of Submission*</u>	<u>Discussion of Concepts**</u>
A	Group Work	Same grade for all group members	By the group	Permitted to discuss (within group)	Permitted
B ¹	Individual w/ Discussions of Concepts and Submission	Individual grade	Individual preparation	Permitted to discuss; sharing solutions or submission files is not allowed	Permitted
B ²	Individual w/ Discussions of Concepts Only	Individual grade	Individual preparation	Not permitted to share/discuss solutions or submission	Permitted
C	Individual	Individual grade	Individual preparation	Not permitted to share/discuss solutions or submission	Not permitted***

* The designated group can be either an assigned study group or a self-selected one.

ATTENDANCE POLICY

Students are required to attend each class. Students should reach out to the [Office of Student Affairs \(OSA\)](#) by using Core Absence Form on this course's Canvas page regarding excused absences (for religious observances; personal, medical, and family emergencies; military service; court appearances such as jury duty). Unexcused absences will affect your course grade as follows:

- Students that miss more than **33%** of their classes (unexcused absences) will at most receive a **P for the course grade**
- Students that miss more than **50%** of their classes (unexcused absences) will receive a **F for the course grade**

In addition to the effect on your final course grade, absences may also affect your final exam grades as follows:

- Students that miss the exam for an **excused** reason but are unable to take the exam within the stated make-up period will receive a **zero for the final exam grade**
- Students that miss the exam without notifying OSA (**unexcused**), will receive an **F for the course grade**

INCLUSION, ACCOMMODATIONS, AND SUPPORT FOR STUDENTS

At Columbia Business School, we believe that diversity strengthens any community or business model and brings it greater success. Columbia Business School is committed to providing all students with the equal opportunity to thrive in the classroom by providing a learning, living, and working environment free from discrimination, harassment, and bias on the basis of gender, sexual orientation, race, ethnicity, socioeconomic status, or ability.

Columbia Business School will make reasonable accommodations for persons with documented disabilities. Students are encouraged to contact the Columbia University's Office of Disability Services for information about registration. Students seeking accommodation in the classroom may obtain information on the services offered by Columbia University's Office of Disability Services online at www.health.columbia.edu/docs/services/ods/index.html or by contacting (212) 854-2388.

Columbia Business School is committed to maintaining a safe environment for students, staff and faculty. Because of this commitment and because of federal and state regulations, we must advise you that if you tell any of your instructors about sexual harassment or gender-based misconduct involving a member of the campus community, your instructor is required to report this information to a Title IX Coordinator. They will treat this information as private, but will need to follow up with you and possibly look into the matter. Counseling and Psychological Services, the Office of the University Chaplain, and the Ombuds Office for Gender-Based Misconduct are confidential resources available for students, staff and faculty. "Gender-based misconduct" includes sexual assault, stalking, sexual harassment, dating violence, domestic violence, sexual exploitation, and gender-based harassment. For more information, see <http://sexualrespect.columbia.edu/gender-based-misconduct-policy-students>.