

Georgia Tech Institute of Technology - Scheller College of Business
MGT 2250 - Management Statistics (Spring, 2017)
Class: TR, 4:35 - 5:55 in College of Business 222

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Office hours: TR, 3:30 – 4:30 pm at Room 4261, College of Business. Or by appointment.

1) Course Description

Statistics is the art and science of making data-based decisions. For managers, statistics is a tool to help them to make “factual decisions”. This course introduces statistical concepts that are most important for the practical analysis of management decisions, presenting the material in the context of realistic business situations from a variety of areas: finance, banking, marketing, advertising, operations, real estate, accounting, and human resource.

This course focus on understanding several concepts and interpreting the results of statistical analysis rather than details of calculation. The introduction part starts with the basic terminology, summary statistics, and graphical summaries. The first part will present the concept of a random variable (idealized description of the data in applications). The second part will cover statistical inference - the process of inferring properties of an entire population from those of a subset known as a sample. The third part introduces regression models (an important tool in business for assessing profitability, setting prices, identifying anomalies, and generating forecasts).

2) Learning Outcomes

The general goal of this course is to develop statistical literacy and reasoning. Statistical literacy means recognizing statistical terms, symbols, and representations of data. Statistical reasoning involves understanding the logic behind the statistical procedures and being able to fully interpret statistical results.

Specific learning outcomes for each lecture are described in the “Course Schedule” section of this syllabus.

Furthermore, after this course students will become proficient in using a spreadsheet software (Excel) to manage datasets, create tables and graphics, perform statistical tests, run simple regressions, and etc.

3) Required Material

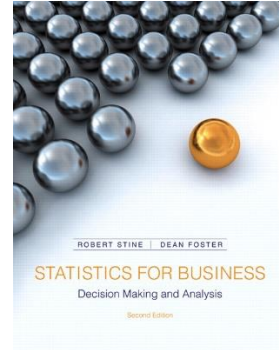
3.1) MyStatLab

MyStatLab is an electronic platform that **includes the ebook** and multimedia resources (StatTalk and Business Insight Videos, and Excel Tutorials). We are going to use MyStatLab for homework and Tests.

Textbook: Statistics for Business: Decision Making and Analysis, Robert A. Stine & Dean Foster, 2nd Edition. Publisher: Pearson.

The last time that I checked the publisher website, MyStatLab (inside there is the ebook) online purchase price was \$99.95. See the instructions in the Appendix to register in MyStatLab.

If you want to buy the textbook (hardcopy) from a bookstore, be sure that you buy the bundle (Textbook + access code for MyStatLab). ISBN: 9780321921772.



3.2) Laptop with Microsoft Excel 2016

You have to bring your Laptop with Microsoft Excel 2016 for Tests in class. It is unfeasible to deal with real dataset by hand.

Georgia Tech in coordination with Microsoft provides Office 365 Pro Plus **for free**. It is a full version Office available for offline use. You can install Office on up to five machines being Mac or PC. Please, if you don't have Excel in your Laptop yet, check the website: <http://office365.gatech.edu>.

4) Course Schedule

Introduction

Date	Chapters of Stine & Foster 2 nd and Lecture Bullet Points	Objective/ Learning Outcome
Week 1 Jan 10	Syllabus – Course Presentation 1. Introduction A) Statistic. B) Variation. C) Patterns. D) Statistical Model. 2. Data A) Numerical Variables. B) Categorical Variables. C) Ordinal Variables. D) Measurement Unit. E) Likert Scale. F)	<ul style="list-style-type: none">• Overview of the course.• Introduce the statistical reasoning.• Organize data into a table with multiple variables (columns) and cases (rows).• Distinguish categorical from numerical variables.• Recognize time series data.

	Recode. G) Aggregate. H) Frequency. I) Cross-Sectional Data. J) Time Series.	<ul style="list-style-type: none"> Identify when recoding or aggregating data are useful.
Week 1 Jan 12	3. Describing Categorical Data A) Frequency Table. B) Distribution. C) Relative Frequency. D) Variation in Data. E) Bar Chart. F) Pareto Chart. G) Pie Chart. H) Area Principle. I) Mode. J) Median.	<ul style="list-style-type: none"> Create, describe, and interpret the distribution of a categorical variable and link this distribution to variation. Follow the area principle as a guide when preparing displays of data or interpreting the graphs of others. Identify the mode and median.
Week 2 Jan 17	5. Association between Categorical Variables A) Contingency Tables. B) Mutually Exclusive. C) Marginal Distribution. D) Conditional Distribution. E) Associated. F) Stacked Bar Charts G) Mosaic Plots. H) Lurking Variable. I) Simpson's paradox. J) Chi-Squared. K) Cramer's V	<ul style="list-style-type: none"> Form a contingency table from two categorical variables. Connect marginal distributions of a contingency table to bar charts and distributions of a single categorical variable. Link conditional distributions in a table to stacked bar charts and mosaic plots. Calculate and interpret measures of association for categorical variables.
Week 2 Jan 19	4. Describing Numerical Data A) Median. B) Quartile. C) Interquartile Range (IQR). D) Range. E) Mean. F) Variance. G) Standard Deviation. H) Coefficient of Variation. I) Histogram. J) Outlier. K) White Space Rule. L) Boxplot. M) Mode. N) Uniform. O) Symmetry. P) Skewness. Q) Tails. R) Bell-Shaped. S) Empirical Rule. T) Standardizing. U) Z-Score.	<ul style="list-style-type: none"> Prepare, describe, and interpret a histogram that summarizes the distribution of a numerical variable. Calculate, interpret, and contrast the mean and the median. Calculate, interpret, and contrast the interquartile range (IQR) and the standard deviation (SD). Interpret a boxplot and link it to the distribution (histogram). Distinguish bell-shaped distributions from bimodal (multimodal) distributions and from skewed distributions.
Week 3 Jan 24	6. Association between Quantitative Variables A) Scatterplots. B) Response. C) Explanatory Variable. D) Visual Test for Association. E) Covariance. F) Correlation. G) Spurious Correlation. H) Correlation Matrix.	<ul style="list-style-type: none"> Recognize and describe the strength and direction of association between two numerical variables from a scatterplot. Calculate and interpret the amount of linear association using covariance and correlation. Distinguish association from causation.

Part 1 – Probability

Date	Chapters of Stine & Foster 2 nd and Lecture Bullet Points	Objective/ Learning Outcome
Week 3 Jan 26	9. Random Variables A) Discrete Random Variable. B) Continuous Random Variable. C) Probability Distribution. D) Statistical Model E) Parameter. F) Mean. G) Expected Value. H) Variance. I)	<ul style="list-style-type: none"> Use the language of probability to represent uncertain outcomes as random variables. Find the mean and variance of random variables from their probability distributions.

	Standard Deviation. J) Rules for Expected Values. K) Sharpe Ratio.	<ul style="list-style-type: none"> Manipulate the mean, variance, and standard deviation of random variables when transformed by adding or multiplying by a constant.
Week 4 Jan 31	10. Association between Random Variables (I) A) Joint Probability Distribution. B) Independent random variables. C) Sums of Random Variables.	<ul style="list-style-type: none"> Use several possibly dependent random variables to model the outcomes of simultaneous random processes. Find the mean and variance of a weighted sum of possibly dependent random variables.
Week 4 Feb 2	10. Association between Random Variables (II) D) Covariance. Correlation. E) Identically Distributed. F) Independent and Identically Distributed.	<ul style="list-style-type: none"> Distinguish when two random variables are dependent or independent. Link iid random variables to simple data suitable for summarizing with a histogram.
Week 5 Feb 7	12. The Normal Probability Model (I) A) Central Limit Theorem. B) Continuous Random Variable. C) Normal Model. D) z-score. E) Standard Normal Random Variable	<ul style="list-style-type: none"> Associate normal models with bell-shaped distributions of data and the Empirical Rule. Connect normal distributions to sums of like-sized effects with the Central Limit Theorem.
Week 5 Feb 9	12. The Normal Probability Model (II) F) Quantile. G) Normal Quantile Plot. H) Skewness. I) Kurtosis.	<ul style="list-style-type: none"> Use histograms and normal quantile plots to judge whether data match the assumptions of a normal model.
Week 6 Feb 14	Review – Sample Test 1	
Week 6 Feb 16	Test 1 Chapters: 9, 10, and 12.	

Part 2 – Inference

Date	Chapters of Stine & Foster 2 nd and Lecture Bullet Points	Objective/ Learning Outcome
Week 7 Feb 21	13. Samples and Surveys A) Survey. B) Population. C) Sample. D) Representative. E) Bias. F) Randomization. G) Simple Random Sample (SRS). H) Parameter. I) Statistic. M) Estimate. N) Sampling Variation. O) Stratified Random Sample. P) Cluster Sampling. Census. Q) Voluntary Response Sample. R) Survivor Bias.	<ul style="list-style-type: none"> Explain why random selection is typically the best way to get a representative sample. Select a simple random sample from a sampling frame. Appreciate that survey results depend on which sample is taken, producing sampling variation. Distinguish population parameters from sample statistics. Avoid common sources of bias in survey design.
Week 7 Feb 23	15. Confidence Intervals (I) A) SE vs. se. B) z-interval. C) Confidence Level. D) Student's t-distribution. E) Degrees of Freedom (df). F) Manipulating Confidence Intervals.	<ul style="list-style-type: none"> Find confidence intervals for population proportions and means using a normal distribution or a t-distribution. Interpret the meaning of a confidence interval in everyday language and explain how the size of the sample influences the width of the interval.

	G) Margin of Error. H) Pilot Sample.	<ul style="list-style-type: none"> Find confidence intervals for population proportions and means using a normal distribution or a t-distribution. Interpret the meaning of a confidence interval in everyday language and explain how the size of the sample influences the width of the interval.
Week 8 Feb 28	16. Statistical Tests (I) A) Null Hypothesis. B) Alternative Hypothesis. C) One-sided hypotheses. D) Two-sided hypotheses. E) Type I and II Errors. F) Test Statistic. G) z-statistic. H) z-test. I) Statistically Significant. M) p-value. N) Power.	<ul style="list-style-type: none"> Identify null and alternative hypotheses. Choose an appropriate α level for a test. Perform a z-test for a proportion. Recognize the possibility of a Type II error when designing a test. Perform a z-test for a proportion.
Week 8 Mar 2	16. Statistical Tests (II) O) t-statistic. P) t-test. Q) Significance versus Importance. R) Confidence Interval or Test?	<ul style="list-style-type: none"> Perform a t-test for a mean. Distinguish statistical significance from substantive significance. Relate confidence intervals to two-sided tests.
Week 9 Mar 7	17. Comparison (I) A) Experiment. B) Factor. C) Treatment. D) Randomization. E) Confounding. F) Two-Sample z-Test for Proportions. G) Statistically Significantly Different.	<ul style="list-style-type: none"> Recognize confounding that distorts the comparison of two populations unless an experiment has been used. Formulate hypotheses for comparing two proportions or two means. Perform a z-test for the difference between two proportions.
Week 9 Mar 9	17. Comparison (II) H) Two-sample t-statistic. I) Two-sample confidence interval. J) Paired Comparison.	<ul style="list-style-type: none"> Perform a t-test for the difference between two means. Distinguish between paired samples and independent samples. Use a single confidence interval for the difference to compare two proportions or two means.
Week 10 Mar 14	Review – Sample Test 2	
Week 10 Mar 16	Test 2 Chapters: 13, 15, 16, and 17.	
Week 11 Mar 21	Spring Break	
Week 11 Mar 23	Spring Break	

Part 3 – Regression

Date	Chapters of Stine & Foster 2 nd and Lecture Bullet Points	Objective/ Learning Outcome
Week 12 Mar 28	19. Linear Patterns (I) A) Response. B) Predictor. C) Fitted Value. D) Residual. E) Least Squares Regression. F) Extrapolation.	<ul style="list-style-type: none"> Identify and graph the response and explanatory variable associated with a linear regression equation. Interpret the intercept and slope that define a linear regression equation.

Week 12 Mar 30	19. Linear Patterns (II) G) Standard Error of the Regression. H) R-squared. I) Simple Regression. J) No Obvious Lurking Variable Condition. K) Linear Condition. L) Random Residual Variation Condition.	<ul style="list-style-type: none"> Summarize the precision of a fitted regression equation using the r^2 statistic and the standard deviation of the residuals.
Week 13 Apr 4	21. The Simple Regression Model (I) A) Conditional Mean. B) Error. C) Estimated Standard Error.	<ul style="list-style-type: none"> Explain the role of the error terms in the SRM and their connection to residuals in regression analysis. Check the conditions needed before applying the SRM to data.
Week 13 Apr 6	21. The Simple Regression Model (II) D) Confidence Intervals. E) Equivalent Inferences for the SRM. F) Prediction Intervals.	<ul style="list-style-type: none"> Form confidence intervals for and test hypotheses about the slope and intercept in a regression model. Find prediction intervals for predictions from a regression and distinguish these from similar confidence intervals.
Week 14 Apr 11	23. Multiple Regression (I) A) Scatterplot Matrix. B) Calibration Plot. C) Adjusted R-squared. D) Residual Degrees of Freedom. E) Partial Slope. F) Marginal Slope. G) Collinearity.	<ul style="list-style-type: none"> Use a correlation matrix and scatterplot matrix to determine the association between a response and several explanatory variables. Interpret the estimated coefficients in a multiple regression, distinguishing partial slopes in the multiple regression from marginal slopes found in a simple regression.
Week 14 Apr 13	23. Multiple Regression (II) H) F-test. I) F-statistic. J) Prediction Intervals. K) Steps in Fitting a Multiple Regression.	<ul style="list-style-type: none"> Test hypotheses about the overall fit of a multiple regression using the F-statistic, and test hypotheses and form confidence intervals associated with specific coefficients using t-statistics. Check the conditions required by the multiple regression model using various residual plots.
Week 15 Apr 18	Review – Sample Test 3	
Week 15 Apr 20	Test 3 Chapters: 19, 21, and 23.	

Final Exam

Week 16 Apr 25	No lecture Office Hour in the classroom	
Week 16 Apr 27	Final Exam (Part 1, Part 2, and Part 3)	Thursday at 2:50-5:40

5) Grading

5.1) Your final grade will be assessed as follows:

Assignment	Weight	Date	Chapters (Stine & Foster)
Surveys*	1%	Thursday, Feb 16 (at 4:00 pm)	
Homework	18%	One week after I finish the chapter (at 4:00 pm).	3, 4, 5, 6, 9, 10, 12, 13, 15, 16, 17, 19, 21, and 23.
Test 1	27%	Thursday, Feb 16	9, 10, and 12.
Test 2	27%	Thursday, Mar 16	13, 15, 16, and 17.
Test 3	27%	Thursday, Apr 20	19, 21, and 23.
Total	100%		

A: 90% B: 80% C:70% D: 60% F: Below 60%

* You can answer the surveys “Demographics and Study Methodology” and “Early Course Evaluation” on Tests and Quizzes section of T-Square.

5.2) Homework

I already posted/scheduled all Homework on MyStatLab. There is no HW for chapter 1 and 2. There are 3 categories of exercises in MyStatLab database: 1) Matching and True/False - test students' ability to recognize the basic mathematical symbols and terminology; 2) Think About It - exercises that ask students to pull together the chapter's concepts in order to solve conceptual problems; and 3) You Do It - exercises that apply the methods of the chapter to data related to a business application (usually it is necessary to use Excel for this type of exercise). I carefully selected exercises for your HW, in order to improve/develop your statistical reasoning and spreadsheet skills. Therefore, +/- 25% of exercises belongs to category 2 and the rest 75% to category 3.

I recommend you to attend my lecture and read the Textbook, before submitting the HW. Keep in mind that you have only one chance for multiple choice questions and maximum of 3 submissions for numerical questions.

In the “Quiz” section of MyStatLab, you can find exercises from category 1. They are reasonable exercises for warm-up, but they are not enough to master the material. Exercises from “Quiz” section don’t count for your grade.

It is a good idea to work in group. Cooperation is not only allowed but encouraged. However, each student has to submit his/her own HW.

5.3) Tests

There will be four Tests in class. Each test will be of 75 minutes duration. All Tests (1, 2, and 3) will start at 4:35 pm and end at 5:50 pm. **You must bring your laptop with MyStatLab and Excel for the Tests.** Only the first submission is allowed and counted for your grade. Therefore, review carefully your Test before submit it. Tests are individual based, that is, no communication with other people. However, **Tests are open-book and open-notes.** I already posted the Sample Tests on T-Square. It is a poor strategy to memorize the content. Please, focus on understanding the key concepts/tools, and how to implement the statistical procedures in Excel. Ask yourself if you are able to verbalize in plain English, represent graphically and algebraically, and apply to different contexts the concepts learned in the class.

5.4) Final Exam

Final Exam follows the same format and rules of the Tests 1, 2, and 3. The difference is that **Final Exam is optional.** After the Test 3, I will calculate your grade, and if you are not satisfied, you can take the Final Exam (Part 1, Part 2, and Part 3) to substitute your Test score (Test 1, Test 2, and Test 3). It is up to you to decide what part to retake. For example, if you take Final Exam Part 2 and Final Exam Part 3, I will substitute your score of Test 2 and Test 3. I will keep your highest score between Tests and Finals, that is, you can only improve your situation and not get worse.

5.5) Makeup Policy for Tests

If you miss Tests, I will provide a makeup activity in the case of health reasons or official GT events. You will need to show one of the following documentation:

(a) If you are ill – the accompanying doctor's note must say that you cannot (or could not) take the Test. If the doctor's note does not state this clearly, your score on the missed Test will be zero. Merely producing a note saying that you visited the GT health center does not count as a valid reason; the note must specifically state that you were in no position to take the Test.

(b) For GT approved official activities that you have to participate in. You will have to produce the relevant official GT documentation noting this fact. The activity that you participate in has to be significant – e.g. you are on a GT team with an official participation date that is the same day as the Test day.

6. Course Expectations

6.1) Prerequisite

Official prerequisite stipulated by Scheller College of Business for this course is: MATH 1712 or MATH 17X2 or MATH 1501 or MATH 15X1 or MATH 1550 or MATH 1551.

6.2) Clarifying Expectations

To succeed in this course, you'll need to invest a good amount of time and energy doing exercises outside the class time. If at any time you feel you're investing the required time and energy but aren't learning the material or improving your skills, contact me and I'll do my best to help you and to suggest additional resources and options. If you have questions or concerns that you believe can be handled via e-mail, feel free to contact me that way. If I cannot adequately respond to your question via e-mail, I'll ask you to come to my regular office hours or make an appointment.

6.3) Extra Credit

You can self-report your attendance at Test & Quizzes section of T-Square. If you have more than 80% attendance, I will add 1 extra point (1%) to your final grade. If you have more than 90% attendance, I will add 2 extra point (2%) to your final grade.

6.4) Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please see The Georgia Institute of Technology 2015-2016 Catalog at <http://www.catalog.gatech.edu>. Refer specifically to section 18b entitled "Academic Honor Code" at <http://www.catalog.gatech.edu/rules/18b.php> for the principles, policies, and procedures governing issues of academic integrity.

6.5) Special Accommodations

Students requesting academic accommodations based on a documented disability are required to register with the Access Disabled Assistance Program for Tech Students (ADAPTS). Please obtain a form from the ADAPTS office and turn it in to me in the beginning of the semester.

The ADAPTS Office is located in the Smithgall Student Services Building, Suite 220. The phone number is 404- 894-2563. <http://www.adapts.gatech.edu/index.html>