Stat 107: Introduction to Business and Financial Statistics

Syllabus for Fall Semester 2016<Tentative-subject to revision>

This syllabus is required reading for the course. You will be expected to understand the policies and assignments discussed in the syllabus.

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Course Description: This course introduces the technical skills required for data-driven analysis of business and financial data. Emphasis is placed on applying statistical methods to summarize and make inferences from complex data and to develop quantitative models to assist business decision making. The software packages Excel and R will be used to obtain quantitative solutions to financial problems. Topics include: understanding the concept of risk, portfolio construction and analysis, regression and time series models used in finance and simulation techniques.

Texts: There is no one assigned text for the course. Class notes will be handed out, and several texts will be referred to which we have electronic access from Hollis. Some books we will use include

- Daroczi, *Introduction to R for Quantitative Finance*
- Georgakopoulos, *Quantitative Trading with R*
- Brooks, *Introductory Econometrics for Finance*
- Ruppert, *Statistics and Data Analysis for Financial Engineering*
- Teetor, *The R Cookbook*
- Ugarte, *Probability and Statistics with R*
- Ang, *Analyzing Financial Data and Implementing Financial Models Using R*

Class meetings: The class meets Mon/Wed from 9:30-11am. Weekly sections will be used to discuss homework, do extra problems and review concepts. Attending section is optional, although strongly recommended. There will be no sectioning so students can attend any/all sections they want.

Computing: The course will use Excel and R. Details on obtaining R (a free statistical computation platform) will be discussed in class.

Grading:

Homework (20%). Methods are tools and it isn't very instructive to read a lot about hammers or watch someone else wield a hammer. You need to get your hands on a hammer or two. Thus, in this course, you will have homework on (roughly) a weekly basis. They will be a mix of analytic problems, computer simulations, and data analysis. For all sections, the homework will be assigned on Wednesday and due the following Tuesday by 11:59pm. The homework should be typed and well-formatted, with tables, code and figures incorporated into the text. No late homework will accepted except in the case of a documented emergency. Homework will be downloaded and uploaded via the Canvas course system.

Homework assignments will be graded on a scale from 1 to 5.Homeworks are graded in large part on the clarity of your presentation of the solutions, not just their correctness. Homeworks that are generally clear and correct will earn scores of 4 or 5; those less so will earn a 3. Sloppy and/or incomplete homeworks will receive a 1 or 2. All homeworks will count toward your course grade { we will not drop any homework grades. At the end of the course, homework scores are converted into a 0-100 scale. A homework score of 5 is converted to 100; a score of 4 is converted to 90; a score of 3 is converted to 80; a score of 2 is converted to 65; and a score of 1 is converted to 50. Also, a homework score of 0 (not handing in your homework) is converted to a 0 on a 100 point scale. In other words, if x is a homework score, then the converted score y is given by

$$y = \frac{5}{12}x^5 - \frac{35}{6}x^4 + \frac{365}{12}x^3 - \frac{445}{6}x^2 + \frac{595}{6}x$$

Midterm (30%). There will be an in class midterm on October 24th.

Final Exam (40%). There will be an in class final on the assigned final exam date.

Group Project (10%). A report of a business/financial application (simulation, model or replication of result from literature) will be prepared by each student group. Each group will select their own topic. The groups may consist of 3-5 students. Anyone wishing to work alone or with a slightly larger group must obtain the consent of the instructor. Details of this project will be handed out towards the middle of the course. The project will be due December ??(to be determined).

Missed Exams

Harvard's policy on missed exams may be found here :
(http://static.fas.harvard.edu/registrar/ugrad_handbook/current/chapter2/attendance_absences_etc.html)
Students who miss an exam due to a religious observance are entitled to a make-up exam. For any other excused absence (medical, sports or certain club activities) the remaining exam percentages will be reweighted and a make-up will not be offered.

Academic Honesty and Collaboration

Academic honest is a tricky subject when dealing with coding and math type problems, since it is much easier to copy answers than say a written essay.

I have taken useful elements from the EC10 and CS50 course policies to assist in understanding what is allowed and not allowed. Actually, in full disclosure, most of below is from CS50 because it summarizes everything exceedingly well.

This course's philosophy on academic honesty is best stated as "be reasonable." The course recognizes that interactions with classmates and others can facilitate mastery of the course's material. However, there remains a line between enlisting the help of another and submitting the work of another. This policy characterizes both sides of that line.

The essence of all work that you submit to this course must be your own except of course in group projects.

Collaboration on problem sets is not permitted except to the extent that you may ask classmates and others for help so long as that help does not reduce to another doing your work for you.

Below are rules of thumb that (inexhaustively) characterize acts that the course considers reasonable and not reasonable. If in doubt as to whether some act is reasonable, do not commit it until you solicit and receive approval in writing from the course's heads. Acts considered not reasonable by the course are handled harshly. If the course refers some matter to the Administrative Board and the outcome is Admonish, Probation, Requirement to Withdraw, or Recommendation to Dismiss, the course reserves the right to impose local sanctions on top of that outcome that may include an unsatisfactory or failing grade for work submitted or for the course itself.

On the following page are a list of good and bad things to do when collaborating. In summary though, If a fellow student asks if you would like to discuss a homework problem, we encourage you to say "yes"; if a fellow student asks to see your answer to a homework problem or R code, the answer is "no."

Reasonable Collaboration

1) Communicating with classmates about problem sets' problems in English (or some other spoken language).
2) Discussing the course's material with others in order to understand it better.
3) Helping a classmate identify a bug in his or her code at office hours, elsewhere, or even online, as by viewing, or running his or her code, even on your own computer.
4) Incorporating snippets of code that you find online or elsewhere into your own code, provided that those snippets are not themselves solutions to assigned problems and that you cite the snippets' origins.
5) Sending or showing code that you've written to someone, possibly a classmate, so that he or she might help you identify and fix a bug.
6) Sharing snippets of your own code online so that others might help you identify and fix a bug.
7) Turning to the web or elsewhere for instruction beyond the course's own, for references, and for solutions to technical difficulties, but not for outright solutions to problem set's problems or your own final project.
8) Whiteboarding solutions to problem sets with others using diagrams or pseudocode but not actual code.
9) Working with (and even paying) a tutor to help you with the course, provided the tutor does not do your work for you.

Not Reasonable Collaboration

1) Accessing a solution to some problem prior to submitting your own.
2) Asking a classmate to see his or her solution to a problem set's problem before submitting your own.
3) Failing to cite (as with comments) the origins of code or techniques that you discover outside of the course's own lessons and integrate into your own work, even while respecting this policy's other constraints.
4) Giving or showing to a classmate a solution to a problem set's problem when it is he or she, and not you, who is struggling to solve it.
5) Looking at another individual's work during the midterm.
6) Paying or offering to pay an individual for work that you may submit as (part of) your own.
7) Providing or making available solutions to problem sets to individuals who might take this course in the future.
8) Searching for or soliciting outright solutions to problem sets online or elsewhere.
9) Splitting a problem set's workload with another individual and combining your work (unless you are in a designated group).
10) Submitting (after possibly modifying) the work of another individual beyond allowed snippets.
11) Submitting the same or similar work to this course that you have submitted or will submit to another.
12) Viewing another's solution to a problem set's problem and basing your own solution on it.

Regrading

Clerical errors will be corrected without any hassle. Other regrade requests must be submitted **in writing** within a week of the items return. To discourage "grade grubbing," the **entire** item will be subject to regrading (even if the regrade request is not honored).

Other learning resources

Office hours will be held by the course instructor, and each teaching fellow.

Students with disabilities:

Students with disabilities who believe they may need accommodations in this class are encouraged to contact the Accessible Education Office as soon as possible to ensure that such accommodations can be made. The course instructor must be informed in writing of any required AEO accommodations at least two weeks before the exam.

Academic Integrity:

Harvard College is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and non-academic endeavors, and to protect and promote a culture of integrity. Cheating on exams and quizzes, plagiarism and copying others' work on homework assignments and projects, lying about an illness or absence and other forms of academic dishonesty are a breach of trust with classmates and faculty, and will not be tolerated. Such incidences will result in a grade of zero for all parties involved as well as being reported to the Administration Board. Please review Harvard's Academic Integrity and Dishonesty policies at
http://handbook.fas.harvard.edu/book/academic-integrity#one

Proposed Class Schedule

Class Number	Date	Topic
1	8/31/2016	Intro to Everything
2	9/5/2016	No Class-Labor Day
3	9/7/2016	Intro to R, quantmod package, prices and returns
4	9/12/2016	Intro to Stat up to Normal, density estimation
5	9/14/2016	CI and Hyp Tests Review
6	9/19/2016	The Bootstrap and Simulation
7	9/21/2016	The Constant Expected Return Model, Part I
8	9/26/2016	The Constant Expected Return Model, Part II
9	9/28/2016	Introduction to Portfolio Theory
10	10/3/2016	Portfolio Theory with Matrix Algebra
11	10/5/2016	Statistical Analysis of Portfolios
12	10/10/2016	**No Class-Columbus Day**
13	10/12/2016	Review of Simple Regression
14	10/17/2016	The Market Model and Beta
15	10/19/2016	The Capital Asset Pricing Model
16	10/24/2016	**Midterm**
17	10/26/2016	Multiple Regression and Dummy Variables
18	10/31/2016	Fama-French and Momentum
19	11/2/2016	Anomalies/Logistic Regression-Timing Models
20	11/7/2016	Basic Concepts of Time Series
21	11/9/2016	Fluctuations-ARMA processes and stationarity
22	11/14/2016	Co-Integrration and Pairs Trading
23	11/16/2016	Modeling Volatility
24	11/21/2016	Risk Measures and Value at Risk
25	11/23/2016	**Thanksgiving**
26	11/28/2016	**Guest Speaker (required attendance)**
27	11/30/2016	Wrap Up Final Classs