Honors Program--Chapman University

Scientific Prediction

HON 350 01 Spring Semester 2016

Course Syllabus

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Instructor	Dr. Kenneth E. Murphy (Ken)
Classroom/Time	M, W 1:00-2:15pm, DeMille 146
Office	BK 303I
Office Hours	M, W 2:30-3:30, T, W 6:00-7:00pm and by appointment
Telephone	714.628.2876 (office)
Email	kmurphy@chapman.edu (←best method to contact the instructor)
Course Webpage	http://blackboard.chapman.edu
Required Texts	Tetlock, P. E., & Gardner, D. (2015). Superforecasting: The Art and Science of Prediction. New York: Crown Publishers. ISBN: 978-0-8041-3669-3 Silver, N. (2012). The Signal and the Noise: Why So Many Predictions Fail-but Some Don't. New York: The Penguin Press. ISBN: 978-1-59420-411-1 Additional readings will also be assigned as needed
Required Technology	MS Excel on your laptop, home computer or in the computer lab is required. Excel will be useful during some class meetings and outside of class. Also, statistical analysis software will be used in this course. All of the recommended technology tools are available in the Chapman University computer labs.
Course Prerequisites	Acceptance to the University Honors Program or consent of instructor
Course Rationale	A student enrolled in this course will develop some context for the evolution of science and prediction including a brief examination of the philosophy and history of science. In particular early discussion will focus on the human desire to predict the future and the development of science to accomplish this task. The nature of data and tools available before the 20th century will be discussed as a mechanism for providing context with regard to current significant changes in this arena. The central focus of the course will begin by developing a framework for scientific prediction. Qualitative techniques for arriving at decision making consensus will provide the first examples of forecasting techniques. Developments in data collection, information technologies and tools and mathematical models for making prediction will follow. Students will develop skills in applying frameworks, basic techniques and tools to prediction problems in a variety of disciplines. Some focus will be placed

on basic decision support systems like MS Excel for managing data and conducting analyses.

The major course project will ask students to hypothesize, make and defend predictions in a context of their choosing. Students will be asked to present context, framework, data, rationale for selected model, the forecast and to evaluate the quality of the forecast. Through this activity students will gain an appreciation for the science and art of making predictions and for communicating these results in a convincing manner to the broader audience.

A position paper broadens the student's understanding of current and ongoing challenges in prediction. In this assignment the student will describe a particular prediction problem, describe the current status of this problem, provide opportunities for the future, and take a stand for a specific future state. Critical thinking of the role of prediction and the associated frameworks is central in this work.

Course Description

This course examines the philosophy and techniques for creating forecasts and making predictions. Historical context of prediction is discussed. Qualitative and quantitative techniques are covered. Traditional quantitative methods and probabilistic approaches will be applied. Evaluation of forecast accuracy and its implications are considered. Prediction applications include, but are not limited to economics, science, social science, business, sports and weather.

Course Learning Outcomes

A student completing this course will be able to:

- Articulate components of the scientific method
- Employ basic statistical inference to make decisions
- Build elementary statistical models from data using software
- Create forecasts and provide forecast errors
- Apply frameworks for evaluating quantitative forecast quality
- Articulate major society's major forecasting challenges and critique the quality of forecasts made in these settings
- Describe probabilistic forecasting techniques and demonstrate the application of Bayes Law
- Apply technical tools including MS Excel where necessary to manage data, create models, make forecasts and evaluate forecast quality
- Gather, organize, model, forecast and present defensible forecasts via oral and written means

Honors and General Education Learning Outcomes

Honors Learning Outcomes:

- Obtained a starting point for integrative exploration of the development of cultures and intellectual achievements through a variety of disciplinary and interdisciplinary perspectives
- Sharpened their ability to critically analyze and synthesize a broad range of knowledge through the study of primary texts and through engagement in active learning with fellow students, faculty, and texts (broadly understood)
- Understood how to apply more integrative and interdisciplinary forms of understanding in the advancement of knowledge and in addressing complex challenges shaping the world
- Developed effective communication skills, specifically in the areas of written and oral exposition and analysis

In short, this course focuses on the gains in the field of forecasting over the course of history, but especially over the past 50 years. Students will learn to critically evaluate data and forecasts for effectiveness. The will gain understanding of the value of good forecasts in society. In addition they will present the results of their own forecast experiment to practice defending their logical analysis of a prediction setting.

GE 7QI Learning Outcome:
Applies and analyzes quantitative methods and techniques

The course will spend a significant percentage of contact hours covering techniques for developing quantitative forecasts and critiquing the results of such methods as well as the methods themselves.

Course Format and Evaluation

A detailed schedule is shown below for all class periods. The classroom sessions will generally be composed of in-class discussions or instructor led activities in which students will discuss readings, homework or the results of in-class activities. See the schedule below. It is likely that there will be outside class sessions, e.g., field trips.

Students are expected to be prepared for class by keeping up with the assigned reading. In this course there is no attendance policy, but students absent from a class will not be given any special dispensation for missing that class.

Students in this course will be evaluated in four components: homework, participation in class, on a course project and based on a course paper.

Participation

Students are required to participate actively in this course during class sessions. In class student participation will count for 20% percent of the overall course evaluation.

Students will be evaluated weekly for weeks 1-14 of the course based on their participation in class. Each week, each student will be awarded a score between 0 and 3 points. The three lowest scores will be dropped from the total participation score at the end of the course. Students will be made aware of the scores every week on Friday or Saturday of that week.

Discussion participation does not require any hard documentation of student preparation, simply, knowledgeable, thoughtful, effective and energetic contribution to the class discussion is required.

Students will be provided with feedback on their participation via Blackboard according to the following scale:
0 – No participation by student attending or student did not attend class
1 – Some contribution to the class sessions
2 – Competent contribution to the class discussion
3 – Insightful and stimulating contribution to the class discussions that influenced the tone and direction of the discussion.

Students will have until Wednesday evening at 11:59 of the next week to contest participation scores with the instructor. Students choosing to dispute participation scores must outline their arguments for additional points and submit this argument via email. The instructor will respond within 2 days (by Friday) with the answer to the student's request. There is no way to make-up in-class participation if the opportunity is missed.

Homework

Students will be assigned homework intermittently during the semester in order to practice concepts covered in the course. Homework assignments will make up 20% of overall course evaluation. The lowest homework assignment score will be dropped.

Homework assignments are meant to provide insight and practice developments in forecasting, mathematics and statistical techniques. There will be at least one week for the completion of each homework assignment. Many of the assignments will concentrate on making and evaluating predictions and forecasts.

Homework assignments may be completed by working with other students in the class, however the final answers submitted should be a student's own work. Homework that is obviously duplicated will result in a zero score for all students who submitted duplicate work. Homework will generally be submitted in hard copy at the beginning of class period in which it is due.

Position Paper

The position paper presents and defend the student's opinion regarding the future with respect to a particular problem or challenge in prediction. The position paper is worth 20% of the overall course evaluation. The

approximately length of the position paper is 10 pages.

The position paper describes a yet to be solved prediction problem. The paper will describe the problem in detail and provide some insight into the current status of this problem. The paper will then take a position as to the solution of the problem at a reasonable fixed point in the future (e.g., 5 years out). Students will present their argument for the status of the problem at that time.

There will be approximately three required deliverables leading to the completion of the position paper throughout the semester. Due dates and additional details on the paper will be made available in a separate document near the beginning of the term.

Individual Course Project

A single individual forecasting project provides practice with building a real prediction model will be assigned during the semester. The project will count for 40% of the overall course evaluation. Each student will choose a prediction or forecasting problem, gather data, establish a forecasting process, build a model, make forecasts, evaluate forecast quality, and provide a critique of their work.

Each class member is required make a class presentation regarding their data, process and results of their forecasting exercise. In addition each student will turn in a brief written report of their forecasting analysis. Students will also provide at least one formal critique of other students' project presentations.

There will be a number of required project deliverables leading to the completion of the course project throughout the semester. The dates and additional details on the course project will be made available in a separate document near the beginning of the term.

Exams/Tests

There are no tests or exams in this course.

Grade Disputes

Students are permitted to dispute any evaluation in the course. All student evaluation scores on participation, homework, report and project will be made available to students on a continuous basis via Blackboard. Students are generally expected to dispute a particular evaluation within a one-week period of the availability of that evaluation (see participation dispute policy above). Failure to dispute a mark within this period indicates that the student has accepted that mark.

First round disputes must be made via email to the instructor. Disputes should include convincing evidence as to why a particular mark should be changed. Convincing evidence should be logical and detailed as to why the assigned grade was not correct. If the dispute is not resolved to the

student's satisfaction, the student may then request a face-to-face meeting with the instructor to further discuss the particular issue.

Final Evaluation Calculations

Final course evaluation will be based on a weighted average of scores on all evaluated work.

The categories and weights are:	Total
Weekly Participation (drop lowest 3)	20%
Homework (drop lowest 1)	20%
Position Paper	20%
Project	40%
Total	100%

Final course letter grades will be assigned on the following scale:

A	95-100 %	C	73-76.9%
A-	90-94.9%	C-	70-72.9%
B+	87-89.9%	D+	67-69.9%
B	83-86.9%	D	63-66.9%
B-	80-82.9%	D-	60-62.9%
C+	77-79.9%	No Pass	<60%

Chapman University's Academic Integrity Policy

Chapman University is a community of scholars that emphasizes the mutual responsibility of all members to seek knowledge honestly and in good faith. Students are responsible for doing their own work and academic dishonesty of any kind will be subject to sanction by the instructor/administrator and referral to the university Academic Integrity Committee, which may impose additional sanctions including expulsion. Please see the full description of Chapman University's policy on Academic Integrity at www.chapman.edu/academics/academicintegrity/index.aspx.

Chapman University's Students with Disabilities Policy

In compliance with ADA guidelines, students who have any condition, either permanent or temporary, that might affect their ability to perform in this class are encouraged to contact the Disability Services Office. If you will need to utilize your approved accommodations in this class, please follow the proper notification procedure for informing your professor(s). This notification process must occur more than a week before any accommodation can be utilized. Please contact Disability Services at (714) 516–4520 or visit www.chapman.edu/students/student-health-services/disability-services if you have questions regarding this procedure or for information or to make an appointment to discuss and/or request potential accommodations based on documentation of your disability. Once formal approval of your need for an accommodation has been granted, you are encouraged to talk with your professor(s) about your accommodation options. The granting of any accommodation will not be retroactive and

cannot jeopardize the academic standards or integrity of the course.

Chapman University's Equity and Diversity Policy

Chapman University is committed to ensuring equality and valuing diversity. Students and professors are reminded to show respect at all times as outlined in Chapman's Harassment and Discrimination Policy. Please see the full description of this policy at http://www.chapman.edu/faculty-staff/human-resources/eoo.aspx. Any violations of this policy should be discussed with the professor, the dean of students and/or otherwise reported in accordance with this policy.

Tentative Class Schedule
Scientific Prediction-Spring 2016

Week	Class Day	Topic	Reading and/or Daily Preparation (for that class)
1	Feb 1	A prediction problem	
	Feb 3	Well-formed prediction problems	(see Blackboard)
2	Feb 8	Prediction and science	(see Blackboard)
	Feb 10	Philosophy of science	(see Blackboard)
3	Feb 15	Is science truth?	Tetlock, Chapter 1 Silver, Intro and Chapter 1
	Feb 17	Prediction and the scientific method	Tetlock, Chapter 2
4	Feb 22	Math models	Tetlock, Chapter 3
	Feb 24	Mathematics of probability	Silver, Chapter 2 (Reading on probability)
5	Feb 29	The role of data in prediction	Silver, Chapter 3
	March 2	Data and context	Silver, Chapter 4
6	March 7	Effective and spurious models	Silver, Chapter 5
	March 9	Statistical significance	(Reading on hypothesis testing)
7	March 14	Modeling building using regression 1	Silver, Chapter 6 (Reading on regression)
	March 16	Forecasts and errors…	Silver, Chapter 7
	March 21/23	Spring Break	
8	March 28	Modeling building using regression 2	Tetlock, Chapter 4
	March 30	Making forecasts using models	Tetlock, Chapter 5
9	April 4	Probabilistic forecasting	Tetlock, Chapter 6
	April 6	Revising forecasts thoughts on process	Tetlock, Chapter 7
10	April 11	Less and less wrong	Silver, Chapter 8
	April 13	Bayes rule	Silver, Chapter 9
11	April 18	Are there better models?	Silver, Chapter 10
	April 20	Machines that learn	Silver, Chapter 11
12	April 25	Practice “guessing”	Tetlock, Chapter 8
	April 27	Consensus forecasting	Tetlock, Chapter 9
13	May 2	Coping with dissonance	Tetlock, Chapter 10
	May 4	How good can one be?	Tetlock, Chapter 11
14	May 9	Project Presentations	(none)
	May 11	Project Presentations	(none)
Finals Week	May 16	Project Presentations	(none)

Tetlock, P. E., & Gardner, D. (2015). Superforecasting: The Art and Science of Prediction. New York: Crown Publishers.

Silver, N. (2012). The Signal and the Noise: Why So Many Predictions Fail-but Some Don’t. New York: The Penguin Press.