

Understanding Uncertainty: Games of Skill and Chance
IFS 2084
Spring 2016

Course Description:

Can we understand random events well enough to predict how they will happen in the future? Well enough to maximize a desired goal when the future is unknown? Well enough to determine when two different occurrences are *really* different? To answer these questions this course introduces and employs two mathematical tools useful in quantifying uncertainty: probability and statistics. The questions posed above will be considered in the context of games of chance, such as card and casino games, and games of skill, such as sporting events.

We will begin with an historical exploration of uncertainty and early attempts to explain it (they usually involved gambling). We examine sources of uncertainty in the world around us and try to gauge when uncertainty becomes too large to ignore. We will use several models from probability and statistics to describe, model, and predict uncertainty both in our daily lives and in the context of games as described above. The limitations of these methods will be examined, as well. In particular, we will look at how statistics and probability are often misused and lead to incorrect conclusions.

Lecture: Monday, Wednesday 11:15 – 12:05

Recitation: Friday

Instructor: Eric Chicken, OSB 210 A

Teaching Assistant: Jeff Nielson, Bio Unit I room 308, j.nielson@stat.fsu.edu

Office hours: Wednesdays, 12:30 – 2:30

Text: *Statistical Reasoning in Sports*, Tabor and Franklin, 2013

Prerequisites: None.

Course Objectives: This course is designated as both a *Regular E-Series* course and a Liberal Studies course in the area of *Critical Analyzers of Quantitative and Logical Claims*. As an *E-Series* course it contains a substantial writing component.

E-Series Objectives. Students will demonstrate the ability to:

- E1** analyze and synthesize information from within and across disciplines to: examine existing questions and problems from a variety of perspectives, formulate novel questions and ideas, and explain these questions and ideas in written and oral formats;

- E2** think creatively and flexibly by envisaging new approaches to real-world scenarios or questions;
- E3** learn, think, and solve problems independently and in teams, as is required to engage in the life-long consideration of, and the fostering of cooperative solutions to, complex problems.

Critical Analyzers of Quantitative and Logical Claims Objectives. By the end of the course, students will demonstrate the ability to:

- Q** analyze problems drawn from real-world scenarios by interpreting and evaluating data and applying appropriate mathematical, statistical, logical, and/or computational models or principles, using appropriate technology, and explaining the results.

Writing Objectives. By the end of the course, students will demonstrate the ability to:

- W** write a technical paper following a standard statistical format.

Specifically, students will meet the general objectives **E1 – E3**, **Q** and **W** above by demonstrating the ability to:

- (a) identify the historical factors leading to the development of mathematical probability;
- (b) name and describe sources of variability in the world around us;
- (c) select the appropriate model to calculate probabilities of random events;
- (d) use mathematical formulae to obtain probabilities and expectations and explain them in clear, easily understood language;
- (e) select the appropriate statistical method to model data;
- (f) use statistical formulae to obtain estimates and predict future values and explain them in clear, easily understood language;
- (g) use Excel as an aid to determining probabilities and calculating statistics;
- (h) state the assumptions needed for probability and statistical models and methods;
- (i) state the restrictions inherent in probability and statistical models and methods;
- (j) write a technical paper in a style common in the statistics discipline;
- (k) collaborate with fellow students.

The objectives objectives **E1 – E3**, **Q** and **W** will be evaluated via in-class quizzes, a writing assignment and an oral presentation.

Course Assignments and Evaluation:

Quizzes. There will be 6 quizzes throughout the semester. Your top 5 quiz scores will be used for your final grade. Each of these 5 quizzes is worth 12%. The combined quiz scores are worth 60% of the course final grade. The final exam period can be used to replace a missing quiz for students with less than 5 quiz scores.

Homework. Homework will be regularly assigned in support of the quizzes and writing assignments, but not collected. The quizzes will reflect the material practiced in homework assignments and material presented in class.

Presentations. The class will be divided into teams. Each team will be given exercises to complete as homework or in class and will then present their results orally. Presentations are worth 5% of the final grade.

Written Assignments. Each student will complete two writing assignments. The first is a group report on variability in our surrounding world. The second is a final project.

Group assignment. This assignment is worth 10% of your grade. Students will form small groups in class and discuss ways in which variability and randomness appear in your day-to-day lives. Each group will create a short 2 page draft essay on their topic. This draft will be reviewed and returned to the group for editing. This essay must include:

- (1) a detailed description of at least two types of randomness;
- (2) a discussion of the sources of variability in (1);
- (3) a comparison of one of the events in (1) to a deterministic event.

This assignment will be completed in three stages.

Stage 1	Small group discussions	Week 3
Stage 2	Submit draft essay	End of week 4
Stage 3	Final essay	End of week 6

Final project. This assignment is worth 25% of your final grade. It will be completed in several stages.

The writing assignment is an 8 to 10 page technical paper on predicting an uncertain outcome using statistical techniques learned in class. The outcomes should fall within the topics discussed in class, i.e., games of skill or chance. This written paper must include:

- (1) a short background on the game you will study;
- (2) a detailed description of the outcome you are trying to predict;
- (3) a discussion of the uncertainty inherent in the measured data;
- (4) a list of possible sources of variability in the outcomes associated with (2) and (3);
- (5) tabulation and description of data collected;
- (6) a statistical analysis of the data, including the appropriate output from software;
- (7) at least one graphical figure based on the data or the statistical analysis of the data;
- (8) a discussion of the appropriateness of the analysis chosen in (6);
- (9) interpretation of the results from the statistical analysis;
- (10) limitations of the interpretation provided in (9).

Details on the format of the paper will be provided in class. It is expected that students will work on the written assignment throughout the semester. To this end, milestones have been set to keep students on track.

Milestone A	Topic selected	End of week 9
Milestone B	Data collection complete	End of week 10
Milestone C	Data analysis complete	End of week 12
Milestone D	Draft due	End of week 13
Milestone E	Final written project due	End of week 15

The grading of the written project is based on the rubric at the end of this syllabus.

Course schedule:

<u>Week</u>	<u>Topic</u>
1	Measurement and variability
2	Historical uses of probability
3	Probability rules and assumptions I
4	Probability rules and assumptions II
5	Conditional probability
6	Expectations vs occurrences
7	Applications I
8	Applications II
9	Random data
10	Point and interval estimates
11	Model estimates
12	Graphical representations
13	Applications III
14	Applications IV
15	Applications V

Course Website:

All pertinent information for this class will be posted on the course website at <http://campus.fsu.edu>. Go to this site for homework assignments, class announcements, important dates, etc.

Software:

We will use Excel in the course. Instructions on using Excel will be provided in class.

Liberal Studies and E-Series:

The *Liberal Studies for the 21st Century Program* at Florida State University builds an educational foundation that will enable FSU graduates to thrive both intellectually and materially and to support themselves, their families, and their communities through a broad and critical

engagement with the world in which they live and work. Liberal Studies thus offers a transformative experience. This course has been approved as meeting the requirements for the E-Series and thus is designed to help you become an interdisciplinary and flexible thinker; a lifelong learner; and a team builder. In addition, this course has been approved for the Liberal Studies disciplinary requirement of Quantitative and Logical Thinking and thus is designed to help you become a critical analyzer of quantitative and logical claims.

In order to fulfill the State of Florida's College mathematics and computation requirement the student must earn a "C" or better in the course.

To demonstrate college-level writing competency as required by the State of Florida, the student must earn a "C" (2.0) or higher in the course, and earn at least a "C" average on the required writing assignments. If the student does not earn a "C" average or better on the required writing assignments, the student will not earn an overall grade of "C" or better in the course, no matter how well the student performs in the remaining portion of the course.

University Attendance Policy:

Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy:

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to ". . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/Academics/Academic-Honor-Policy>.)

Free Tutoring from FSU:

On-campus tutoring and writing assistance is available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of on-campus tutoring options at <http://ace.fsu.edu/tutoring> or contact tutor@fsu.edu. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

Americans With Disabilities Act:

Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Student Disability Resource Center; and (2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class. This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
sdr@admin.fsu.edu
<http://www.disabilitycenter.fsu.edu/>

Syllabus Change Policy:

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

The rubric below will be used for both writing assignments.

Rubric: Competencies

Competency E1	analyze and synthesize information from within and across disciplines to: examine existing questions and problems from a variety of perspectives, formulate novel questions and ideas, and explain these questions and ideas in written and oral formats	Subscore: Avg of 2, 3, 5 below
Competency E2	think creatively and flexibly by envisaging new approaches to real-world scenarios or questions	Subscore: Avg of 1, 7 below
Competency E3	learn, think, and solve problems independently and in teams, as is required to engage in the life-long consideration of, and the fostering of cooperative solutions to, complex problems	Subscore: Avg of 8, 9 below
Competency Q	analyze problems drawn from real-world scenarios by interpreting and evaluating data and applying appropriate mathematical, statistical, logical, and/or computational models or principles, using appropriate technology, and explaining the results	Subscore: Avg of 1, 2, 3, 4, 5, 6 below
Competency W	write a technical paper in a commonly accepted style within statistics, incorporating corrections and edits based on feedback.	Subscore: Avg of 10 below

Rubric: Subscores

		High Achievement	Specific Objectives	Score (1 – 4)	Comments
1	Model Choice (E2, Q)	Addresses real world questions by choosing the correct statistical analysis technique that leads to meaningful solutions. Examines alternate methodologies and considers historical background.	(a), (c), (e)		
2	Assumptions (E1, Q)	Student thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position. Correctly states and verifies the assumptions for the chosen statistical analysis or probabilities are met.	(h)		
3	Analysis and Synthesis (E1, Q)	Produces clear statistical results from data and computer data sets. An effective answer to the problem can be inferred from chosen statistical techniques. Recognizes and describes probability and statistics in the world around us.	(b), (d), (f), (g)		
4	Interpretation (Q)	Correctly interprets the results of a statistical analysis or calculated probabilities in clear and precise terms which may be understood by experts and non-experts alike. Results are stated in the context of the problem.	(d), (f)		
5	Communication (E1, Q, W)	Student expresses unique, well-developed ideas in clear, convincing prose and speech, responding thoughtfully to instructive correction. Clearly communicates a summary of the results of a statistical analysis to peers. The technical level is appropriate for the intended audience.	(d), (f), (j)		
6	Conclusions (Q)	States a conclusion that is a logical extrapolation from the inquiry findings.	(d), (f), (j)		
7	Limitations and Implications (E2)	Discusses in detail limitations of selected analysis and alternate analyses	(i)		
8	Problem Solving in Teams (E3)	Students engage in cooperative efforts to accomplish tasks. Within a team, students experiment, exploring and evaluating the advantages and complications of cooperative problem solving.	(k)		
9	Lifelong Learning and Transfer (E3)	Student makes explicit references to previous learning and applies in an innovative (new and creative) way that knowledge and those skills to demonstrate comprehension and performance in novel situations.	(a), (c), (e)		
10	Technical Format (W)	Student writes in a manner consistent with current statistical practice. Includes appropriate data and figures in paper. Translates mathematical results into easily understood language.	(j)		