

# **Math for Teaching Program**

**Summer I 2016**

## **Math S–304 Inquiries into Probability and Statistics**

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### **Course Description:**

An understanding of basic probability and statistics is increasingly important for students in secondary school as they get ready for today's information age. Probability involves the study of uncertainty, something that surrounds us every day, and statistics provides a way of measuring information that can help to cut through that uncertainty. Beginning with the intuitive frequency interpretation of probability we develop language necessary to answer interesting questions and resolve puzzling paradoxes in probability and statistics (consider the Monty Hall problem and birthday matches), illuminating difficulties that students might encounter learning this material. In this course we work our way through topics such as sample spaces and events, counting principles, basic combinatorics, conditional probability, along with probability distributions and various statistical tests.

### **Course Overview:**

This course is for candidates in the Math for Teaching program who wish to learn more about the teaching and learning of probability and statistics. We will be using both inquiry-based and activity-based learning approaches to acquire the knowledge of probability and statistics needed by teachers in the middle and high school classroom. The course objectives for MATH S–304 are:

- Calculating theoretical and experimental probabilities of simple and compound events, including random variables, independent events, and conditional probability.
- Applications of probability including the use of basic probability to make decisions.
- Understanding various ways to summarize, describe, and compare distributions of numerical data in terms of shape, center, and spread.

- Understanding the statistical processes of data collection, sampling, and analysis.
- Understanding inferential reasoning; inference for means and proportions and differences of means or proportions, including the notion of  $p$ -value and estimating with confidence.
- Exploring relationships between two variables by studying patterns in bivariate data (scatter plots, association, simple linear regression, correlation).
- Understanding how to promote active learning in the classroom with appropriate hands-on devices, activities, and the use of technology.
- Understanding of the probability and statistics in state standards and the Common Core.

## **Major class projects/assignments:**

Major class projects and assignments will consist of the following.

- Daily homework assignments.
- A presentation on a teaching/learning lesson or activity for the middle or high school classroom.

For your presentation you will be asked to work in groups of two or three to present a lesson plan or teaching activity to the rest of the class.

## **Course Expectations/Grading:**

It is expected that everyone in the course will participate regularly in the course. As much of the classes will revolve around cooperative learning, student led presentations, and in-class problem solving. It is expected that a fair amount of time will be invested in this course outside of class time. Others in the class will depend on your work, so please prepare carefully for each class. If something comes up that keeps you from coming to a class, please let me know—we will keep track of attendance as part of your course grade for this class.

More specifically, your grade will be determined as follows:

- Attendance and participation—40%
- Homework assignments—30%
- Group project—30%

Students in this course have a wide range of teaching experience as well as mathematical backgrounds, and so grading will take the amount of effort spent on an assignment into account as well as the overall quality of the assignment itself.

## **Academic Integrity:**

Please note that as a Harvard Summer School student, you are responsible for reading and understanding the Summer School's policies on academic integrity ([www.summer.harvard.edu/policies/student-responsibilities](http://www.summer.harvard.edu/policies/student-responsibilities)) and how to use sources responsibly. Given that the Summer School's Academic Integrity policy states that "Collaboration on assignments is prohibited unless explicitly permitted by the instructor" I want to make it clear that I do give you permission to work with each other on your homework assignments, and in fact I encourage you to work with other students in the class. Ultimately, however, anything you turn in has to be work that you have created and written up on your own, not a copy of someone else's work.

Working with other students is a great way to learn math—having to explain your thoughts and approaches to problems to others can be a wonderful way for you to synthesize your own math understanding. However, anything you turn in needs to be written in your own words. If you collaborate with others, then you should make a note of that on your homework, including whom you have worked with. At no point should you copy work done by others – to help insure that this is not happening, it's a good idea to put aside any notes you might have made while working with other students and start your final homework write-up with a fresh/blank piece of paper. Doing this will also prompt you to think back over your ideas before writing them up, and will help make sure that you understand everything you're turning in and that you have explained it completely on your own.

If you use the internet for references, or to check certain aspects of your work, then you should make this clear on your homework as well. In some sense, you should treat the internet as if it were another collaborator in the class; i.e., do not just copy phrases from the internet (unless you need to provide a direct quote from a particular source, giving it a proper citation), and be sure to write up your work independently of what you have looked up, again starting with a new, blank piece of paper as just mentioned above.

The Summer School has a useful site on the appropriate use of sources that you can reference at <http://www.summer.harvard.edu/campus-life/resources-support-academic-integrity>

## **Disability Services:**

The Summer School is committed to providing an accessible academic community. The Accessibility Services Office offers a variety of accommodations and services to students who might need them. Please visit <http://www.summer.harvard.edu/campus-life/accessibility-student-services> for more information.

If you have any questions about anything in regards to these policies then please be sure to contact me early on during the course. In any event, I look forward to seeing you in class this summer!

## **Tentative Schedule**

Class 1—Monday, June 20: Course orientation, introduction to probability.

Class 2—Tuesday, June 21: Combinatorics and counting problems.

Class 3—Wednesday, June 22: Probability and independent events.

Class 4—Thursday, June 23: Conditional probability.

Class 5—Monday, June 27: Working and presenting problems.

Class 6—Tuesday, June 28: Introduction to statistics, descriptive statistics, measures of central tendency and spread.

Class 7—Wednesday, June 29: Introduction to statistics continued, sampling distributions, and using technology.

Class 8—Thursday, June 30. Hypothesis testing.

No class on Monday, July 4. Independence Day

Class 9—Tuesday, July 5. Estimating with confidence.

Class 10—Wednesday, July 6: Examining bivariate data.

Class 11—Thursday, July 7: Probability, statistics, state standards, and the Common Core. Group project presentations.