

## Course Information

Math 566, **Theory of Statistics** Section 1. Spring 2008

### 1 Textbook and materials

This is a continuation of Math 564 from Fall 2007. The text book for the course is the same viz.,

Statistical Inference by Casella and Berger, second edition.

### Class Time and Place

TTH 9.30 to 10.45. Classes begin Thursday, January 17, 2008.

### 2 Instructor

Yashaswini Mittal  
Math 208, 621-3826  
mittal@math.arizona.edu<sup>1</sup>

### 3 Office Hours

12.30-3.00 T, and 12.30-1.30 Th

### 4 Aim of the Course

The sequence 564 and 566 is intended to provide graduate students in statistics, biostatistics, mathematics and related fields with the concepts of probability theory and mathematical statistics. This will provide foundation for further study in both probability and statistics.

### 5 Dates

Following is a list of important dates. Deadlines will be **strictly** followed. Final exam dates for your own courses can be found from

<http://www.arizona.edu/home/calendars.shtml>

First Day of Classes - January 17  
Last Day to Drop resulting in deletion of course  
enrollment from record - Tuesday Feb 12

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<sup>1</sup>Look at the home page at <http://www.math.arizona.edu/~mittal> for additional information.

Last Day to change to P/F - Tuesday Feb 12  
Last Day to Drop with a "W" (if passing) - Tuesday March 11  
Spring Break - March 15-23  
Last Day of Classes - Wed. May 7  
Final Exams - May 9-14

\* Note that this is the last day to drop a class with a grade of "W" (if passing) or to change to or from audit grading. Instructor's signature on a Change of Schedule form is required. After today, all registration changes require not only the instructor's signature, but also the Dean's signature on a Change of Schedule form. By policy, permission from the Dean to make a registration change requires an extraordinary reason. For all practical purposes, you can consider this the absolute last day when this course can be dropped.

## 6 Administrative Drop

Two successive absences from the class may result in an administrative drop unless you ask prior permission to be absent.

## 7 Examination and Homework

I will assign homework from the textbook after every lecture. You may work together on these or any other problems from the textbook. You may get help from me as well (Of course, I expect that you would have TRIED to do the problem on your own and hence will be able to tell me what you have done.). Occasionally, I will choose some problems from these as officially assigned homework. **Once assigned, all your work HAS TO BE ORIGINAL.** This will be collected a week later and graded. Cumulative homework grade will count 50% of the total grade. **Communication skills count a great deal even in Math. YOU WILL GET GRADED ON IT AS WELL. ALL answers MUST include explanation of the reasoning used to get the answer. Just a numerical answer, WHETHER OR NOT IT IS CORRECT, may count little or nothing as far as the score is concerned.**

I have BOTH continuing and new students in the class. Theoretically, anybody who has ever completed Math 564 before is eligible to take the course. However, the 564 course has changed dramatically in the last semester. Last semester was the first time it was taught as it is proposed for the future. The old and new textbooks will illustrate the difference. I will try to accommodate the needs of new students to a certain extent. However, it is quite obvious that I can not teach the entire course again before starting the new material. If you have any concerns, **I urge you to talk to me as soon as possible.**

Computations is NOT an official part of this course. Last semester, I had a couple of sessions to explain the use of R for computing purposes for those

who desired to learn. As the continuing students know, I strongly believe that facility with computing is a **critically important** part of learning any new statistical methodology. One should also note that last semester covered the probability part of the course and this semester it will be statistics. However, since it is not part of the curriculum, I am not going to make it mandatory **unless majority of the students in the class start using it. If that happens, the remaining hold outs, if any, will have to conform to the wishes of the majority.** This semester, I have scheduled the course in a room (Math 320) where I can bring my laptop and a projector so I can illustrate its use and address any R questions you may have. Because of this, my urging will be a bit stronger and more persistent than last semester.

There will be a final exam at the scheduled time. The scheduled time is **8 AM-10 AM May 13, 2008. If it turns out that majority of the students start using R for computations, COMPUTATIONS WILL BE PART OF THE FINAL EXAM. Even if that does not happen, I will still schedule the final exam in a computing lab so those who want to use R will be free to do so.**

## 8 Incomplete Grades

If you fail to complete the course due to circumstances unforeseen, then you **may** qualify for a grade of I, “incomplete” if *all* of the following conditions are met: (Hint: Since a lot of judgement of the Instructor is used to decide whether those conditions are met or not, it will be safe for you to assume that with a very high probability, you will not meet them.)

1. You have completed all but a small portion of the required work.
2. You have scored at least 50% on all work completed.
3. You have a valid reason for not completing the course on time.
4. You agree to make up the material in a short period of time.
5. You ask for the incomplete grade before the grades are due (viz., 48 hours after the final exam.)

## 9 Special Needs

If you have any special needs as a student such as extra time on exams or religious holidays, bring it to my attention during the first week of classes with the proper documentation for me to sign.

## 10 Syllabus

The course will cover

- **Random Samples**  
5.1 to 5.5 Approximately 3 weeks. (Lectures 1-6)
- **Data Reduction:** Likelihood, sufficient statistic, completeness  
6.1 to 6.3 Approximately 1.5 weeks. (Lectures 7-9)
- **Point Estimation:** Method of moments, maximum likelihood estimation, mean squared error, Cramèr-Rao lower bound, best unbiased estimates  
7.1 to 7.2.2, 7.3.1 to 7.3.3 Approximately 2.5 weeks. (Lectures 10-14)
- **Testing of Hypothesis:** Test statistic, most powerful tests, the Neyman-Pearson lemma, UMP tests, monotone likelihood ratio (MLR), likelihood ratio tests.  
8.1 to 8.2.1, 8.3.1, 8.3.2, 8.3.4 Approximately 2.5 weeks. (Lectures 15-19)
- **Confidence Intervals:** Pivotal quantities, test inversion, sensitivity to assumptions  
9.1 to 9.2.2, 9.3.1, 9.3.2, Approximately 2 weeks. (Lectures 20-23)
- **Bayesian Methods:** Prior and posterior distributions, Bayes estimators, Bayesian tests, Bayesian Intervals  
7.2.3, 8.2.2, 9.2.4 Approximately 2 weeks. (Lectures 24-27)
- **Decision Theory:** Decision rules, loss function optimality  
7.3.4, 8.3.5, 9.3.4 Approximately 2 weeks. (Lectures 28-30)

## 11 R

R is open domain and downloadable from the CRAN site at

<http://cran.r-project.org/>

**Make sure to install the reference manual.**