Biostat 602, Winter 2017

Department of Biostatistics
University of Michigan
Student Information Sheet and Syllabus

Course: Biostatistical Inference, Biostat 602, 4 Credits

Lectures:

Instructor	Time	Location
Ananda Sen	1:10 – 3:00 PM T Th	3695 Medical Sciences II (NLH)

Required Text : *Statistical inference, 2nd edition*
by G Casella and RL Berger (Duxbury: Thomson Learning Inc, 2002)

Reference Texts : *Statistical inference, 2nd edition*
by PH Garthwaite, IT Joliffe, B Jones (Oxford University Press 2002)

Instructor: Ananda Sen
2539 SPH II
e−mail: anandas@umich.edu
Office Hours: Tue 3:30 PM−4:30 PM, Wed 11:00 AM − 12:00 PM
or by appointment

GSI: Youngjin Heo
e−mail: heoyj@umich.edu
Office Hours: W 2:00 PM−3:30 PM (Room M4117 SPH II)

Final Grade Determination :

Assignments	30%
Midterm Exam	30%
Final Exam	30%
Attendance and Participation	10%

Test Schedule : Midterm Exam (in class) Thursday, February 23

Final **(1:30 PM – 3:30 PM)** Thursday, April 27

General Remarks

Purpose: This is the second part of a two-part course that deals with the theoretical foundation of statistical inference. The course aims to provide the basic understanding of point and interval estimation, asymptotic evaluation of estimators, and the principles of hypothesis testing. This course is required for the Masters program in Biostatistics and serves as a recommended course in various other programs throughout the University.

Prerequisite: The prerequisite for this course is Biostat 601 or equivalent. The material for Biostat 601 is contained in Chapters 1 – 5.5 of Casella Berger. Basic calculus and Matrix Algebra are also advisory prerequisites for this course. The prerequisite is strictly enforced. Please feel free to talk to the instructor if you feel handicapped by the prerequisite requirement.

Textbook and reading material: The prescribed textbook by Casella and Berger is a classic and has been a popular choice as a textbook at the Masters level in many statistics and biostatistics programs across the country. The plan is to cover Chapters 6-10 of the book this semester. Some of the course material and examples may be collected from other books and journals in order to provide you with a comprehensive lecture-note. Both the **textbook material and the lecture material** will be required for the assignments and the tests. In addition to the required text, a reference text of the same title by Garthwaite, Jolliffe and Jones is recommended. That book is similar to our text, but is also an excellent source of additional problems. Reading is absolutely crucial for the understanding of the material, especially when there is no time in class to cover every aspect of statistical inference.

Introducing Open Discussion Hours: The material in Biostat 602 may be more difficult for some students compared to others. While there are plenty of office hours between me and the GSI, due to the large size of the class it may still be difficult to be able to accommodate everybody. Besides the office hour may or may not work for every student. In view of this, I am introducing a Friday afternoon open discussion hour. This is a free-format discussion forum regarding Biostat 602 topics and problems. Participation in this is **completely optional**. I am not going to teach any new topics and want to devote this for ideas about solving a given problem. Occasionally I shall ask you to take a short quiz on the topics covered thus far. The quizzes will not be formally graded. We shall meet at **1755 SPH I** between **3:00–4:00 PM** on the following Fridays:

Jan	**6, 13, 20**
Feb	**3, 10, 17**
Mar	**3, 17, 24**
Apr	**7, 14**

Computing: There is no computing requirement for this course as this is primarily a theoretical course. Some simulation algorithms as well as other examples that may be helpful in understanding various aspects of the course topics will be demonstrated using R.

Internet Component: Due to the nature of the course, there will be a heavy use of the whiteboard or the document camera during the lectures. However, a basic lecture aid, all homework assignments, their solutions, and various other supplemental material for the course will be posted on the course website on canvas on a regular basis throughout the semester.

Assignments: There will be weekly assignments over the semester covering both theoretical material as well as applications of the theory. A combination of problems from the text and other supplemental material will be assigned as homework. Your answers should be submitted on standard size ($8\frac{1}{2}''$ by $11''$) paper, with the sheets stapled together provided there is more than one page.

In addition to the homework problems, a suggested set of exercises will be provided as practice problems. It is highly recommended to work out as many of the practice problems as you can as this will always be the most ideal way of understanding the theory and its implementation.

While it is permitted to discuss various aspects of an assignment problem with the instructor or the grader, or another student in your study group, your solution to the assignment **must necessarily** be your work in its entirety. Any form of copying from another person's work will be construed as violation of academic conduct and will be subject to appropriate disciplinary actions as per university guidelines.

Assignments will be due in class on the date mentioned. Late assignments will be assessed a penalty of 20% for each day late, so you are encouraged to submit them on time. Please make arrangements for another student to submit your assignment if you are unable to attend a class on the date of submission.

Grading: Your course grade will be based on the weighting scheme presented above. There is no fixed grading scale for this course; conversion from your percentage score to letter grades will be carried out at the end of the course.

Tests: The midterm will take place on Thursday, February 23, during class hours. The final examination will be held on Thursday, April 27 during **(1:30 PM – 3:30 PM)**. The tests will be held in the regular classroom unless mentioned otherwise. Typically, the tests will be closed-book. More details on the format will be announced in class. Please note that the general policy is **NOT** to have make−up tests in the course. If you have a valid excuse (supported by proper official documentation) for missing a test, alternate arrangements for make-up may be allowed. The final decision, of course, rests on the instructor.

Academic Integrity: Students are expected to conduct themselves academically in an honorable fashion. Courtesy, honesty and respect should be shown by students toward faculty members, guest lecturers, administrative support staff and fellow students. Similarly, students should expect faculty to treat them fairly, showing respect for their ideas and opinions and striving to help them achieve maximum benefits from their experience at the university.

Student academic misconduct refers to behavior that may include plagiarism, cheating, fabrication, falsification of records or official documents, intentional misuse of equipment or materials (including library materials), and aiding and abetting the perpetration of such acts. The preparation of reports, papers, and examinations, assigned on an individual basis, must represent each student's own effort. Reference sources should be indicated clearly. The use of assistance from other students or aids of any kind during a written examination, except when the use of aids such as electronic devices, books or notes has been approved by an instructor, is a violation of the standard of academic conduct. Policies concerning academic misconduct are published in key University documents. Anyone convicted of academic dishonesty in this course will receive a grade of 0.0 in addition to any penalties imposed by the academic conduct committee.

Student Well-Being: SPH faculty and staff believe it is important to support the physical and emotional well-being of our students. If you have a physical or mental health issue that is affecting your performance or participation in any course, and/or if you need help connecting with University services, please contact the instructor or the Office of Academic Affairs. Please

visit http://sph.umich.edu/student-life/wellness.html for information on wellness resources available to you.

Student Accommodations: Students should speak with their instructors before or during the first week of classes regarding any special needs. Students can also visit the Office of Academic Affairs for assistance in coordinating communications around accommodations. Students seeking academic accommodations should register with Services for Students with Disabilities (SSD). SSD arranges reasonable and appropriate academic accommodations for students with disabilities. Please visit https://ssd.umich.edu/topic/our-services for more information on student accommodations. Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of students to provide faculty with reasonable notice of the dates of religious holidays on which they will be absent. Please visit

`http://www.provost.umich.edu/calendar/religious_holidays.html\#conflicts`

for the complete University policy.

Outline of Lectures

Chapter 6 (Section 6.1–6.2)

- Principle of Sufficiency
- Sufficient and Minimal Sufficient statistics
- Ancillary statistics
- Completeness
- Exponential family of distributions

Chapter 7, Chapter 10 (section 10.1)

- Theory of point estimation
- Methods of finding estimators: method of moments, maximum likelihood, Bayesian
- Criteria for evaluating estimators: mean squares error, uniformly minimum variance unbiased estimation, Bayes risk
- Asymptotic evaluation of point estimators

Chapter 8, Chapter 10 (section 10.3)

- Methods of finding tests: likelihood ratio, Bayesian tests, union-intersection and intersection-union tests

- Criteria for evaluating tests: power and size of a test, p-values, uniformly most powerful tests
- Other large-sample tests: Wald test, score test

Chapter 9, Chapter 10 (section 10.4)

- Theory of interval estimation
- Methods of finding interval estimators: pivotal quantities, inversion of a test statistic, Bayesian intervals
- Criteria for evaluating interval estimators: size and coverage probability, Test-related optimality, Bayesian optimality, loss function optimality
- Asymptotic evaluation of interval estimators

Important Dates

Jan 16	Martin Luther King Jr. Day, no classes
Jan 24	Add deadline for regular term classes
	Drop deadline without a "W" grade
Feb 14	Last day for term withdrawal with 50% tuition reduction
Feb 23	Midterm Test
Feb 25−Mar 5	Winter Break
Apr 18	Last day of classes
Apr 27	Final Exam, 1:30 PM−3:30 PM