Spring 2018

BIOS 9133 - Advanced Statistical Theory for Biostatistics II

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Prerequisites: Bios 9131 Advance Statistical Theory for Biostatistics I

Course Credit: This is a three-credit hour course designed for the DrPH core curriculum.

Course Structure: This course is an in-person meeting class.

Catalog Description: This course is a continuation of Advanced Statistical Inference for Biostatisticians I. The additional topics in this course consists of: sample moments and their distributions, the theory of point estimation, the Neyman-Pearson Theory of testing hypotheses, likelihood ratio test, chi-square tests, t-test, F-test, procedures in hypothesis testing, confidence estimation. Prerequisite: A minimum grade of “C” in BIOS 9131.

### Cross-cutting

1. Demonstrate their readiness to work with communities to address public health problems.

2. Select and apply theoretically based interventions to address public health problems.

3. Apply appropriate research methods to address community health problems, particularly among rural and underserved populations.

### Biostatistics Concentration

1. Construct a public health and biomedical research question from ideas, conditions, and events that exist in a rural and urban community, region, state, and nation using critical thinking skills.

2. Demonstrate required skills for translating public health practice objectives to the appropriate biostatistical framework for analysis and interpretation of results.

3. Illustrate sufficient substantive knowledge of advanced biostatistical methods such as multiple regression, logistic regression, survival analysis, longitudinal data analysis, and Bayesian and adaptive methods to interact with biostatisticians and related public health researchers in a meaningful and productive fashion.

4. Communicate biostatistical principles and concepts to lay and professional audiences through both oral and written communication.

### Performance Based Objectives:

At the completion of this course, the student will be able to:

1. Understand and use sample moments and their distributions, random sampling, sample characteristics and their distribution, Chi-square, t-, and F-distribution, Large-Sample theory, distribution of \((\bar{X}, S^2)\) in sampling from a Normal Population and sampling from bivariate Normal distribution.

2. Understand and use of parametric point estimation, problem of point estimation, sufficiency, completeness and ancillarity, unbiased estimation, lower bound for the variance of an estimator, method of moments, maximum likelihood estimators, Bayes and minmax estimation, and the principle of equivariance.

3. Understand and use some fundamental notation of Hypotheses testing, Neyman-Pearson Lemma, families with monotone likelihood ratio, unbiased and invariant tests and locally most powerful tests.
4. Understand and use further results of hypotheses testing, generalized likelihood tests, Chi-square tests, \( t \)-tests, \( F \)-tests.
5. Understand and use confidence estimation, some fundamental notation of confidence estimation, methods of finding confidence intervals, and unbiased and equivariant confidence intervals.

**Overview of the Content to be Covered During the Semester:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Readings</th>
<th>Assignment: Due within 1 week of completion of topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>Continue on some limit Theorems And Sample moments and their distribution. (Learning Objectives: 1)</td>
<td>Chapter 6 and 7</td>
<td>6.2.2, 6.2.5, 6.2.9, 6.2.11, 6.3.5, 6.3.8, 6.4.1, 6.4.7, 6.5.1, 6.5.2, 6.5.5, 6.6.1, 6.6.2, 6.6.5, 7.2.1, 7.2.3, 7.3.4, 7.3.8, 7.4.3, 7.4.4, 7.5.1, 7.5.7, 7.6.6, 7.7.1</td>
</tr>
<tr>
<td>5-10</td>
<td>Parametric Point Estimation (Learning Objectives: 2)</td>
<td>Chapter 8</td>
<td>8.2.2, 8.2.4, 8.2.6, 8.3.1, 8.3.2, 8.3.4, 8.3.11, 8.4.3, 8.4.5, 8.4.9, 8.4.11, 8.5.1, 8.5.5, 8.5.8, 8.5.11, 8.6.5, 8.7.1, 8.7.2, 8.7.8, 8.7.10, 8.8.7, 8.9.1</td>
</tr>
<tr>
<td>11-14</td>
<td>Neyman-Pearson Theory of Testing Hypotheses &amp; Some Further Results of Hypothesis testing (Learning Objectives: 3, 4)</td>
<td>Chapter 9, 10</td>
<td>9.2.1, 9.2.6, 9.3.1, 9.3.4, 9.3.11, 9.4.1, 9.4.2, 9.4.6, 9.5.1, 9.5.4, 9.6.2, 10.2.1, 10.2.4, 10.3.1, 10.3.4, 10.4.3, 10.4.8, 10.4.10, 10.5.1, 10.5.5, 10.6.3</td>
</tr>
<tr>
<td>15-16</td>
<td>Confidence Estimation (Learning Objectives: 5)</td>
<td>Chapter 11</td>
<td>11.3.3, , 11.3.5, 11.3.7, 11.3.13, 11.4.1, 11.4.5, 11.5.3, 11.5.3, 11.5.4, 11.5.5</td>
</tr>
</tbody>
</table>

Samples of your work may be reproduced for search purposes and/or inclusion in the professor’s teaching portfolio. You have the right to review anything selected for use, and subsequently ask for its removal.

**Instructional Methods:** Class meeting will be a combination of lecture, class discussion and active participation. PowerPoint presentations (you can find and download from Folio) will be used in the lecture portion of this course. Prior to each lecture, the student is encouraged to complete the recommended reading and actively participate in the class discussion. In this way, it
is hoped that the learner will be better prepared to successfully accomplish the learning objective of each lecture experience.

**Exam Schedule and Final Examination:**

- Midterm Examination: March 13, 2018
- Final Examination: May 1, 2018; 5:30 pm-7:30 pm

**Grading:** Weighting of assignments for purposes of grading will be as follows:

<table>
<thead>
<tr>
<th>Assignment Type</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm Exam (in class and take home)</td>
<td>150 points (30%)</td>
</tr>
<tr>
<td>Final Exam (in class)</td>
<td>150 points (30%)</td>
</tr>
<tr>
<td>Assignments and final project</td>
<td>200 points (40%)</td>
</tr>
</tbody>
</table>

Total Possible Points: 500 points (100%)

The following point scale will be utilized in grading:

- 450-to-500 points (90%) A
- 400-to-449 points (80%) B
- 350-to-399 points (70%) C
- 300-to-349 points (60%) D

A cumulative total of 299 points or less will be considered as failing.

For calculation of your final grade, all grades above will be included.

Your grades *will not* be posted. All exams and assignments will be graded and returned promptly so that students may accurately calculate their grades at any point in time during the semester.

There are times when extraordinary circumstances occur (e.g., serious illness, death in the family, etc.). In such circumstances, and/or if you need additional time to satisfactorily complete any course requirement, please consult with the instructor within a reasonable amount of time.

*Nota Bene:* Extensions are not guaranteed and will be granted solely at the discretion of the instructor.

NO EXTRA CREDIT PROJECTS WILL BE ASSIGNED!
Academic Misconduct: "According to the Academic Dishonesty Policy of GSU, Plagiarism includes (but is not limited to):
A. Directly quoting the words of others without using quotation marks or indented format to identify them.
B. Using published or unpublished sources of information without identifying them.
C. Paraphrasing material or ideas without identifying the source.
D. Unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic material.

If you are accused of plagiarism by a JPHCOPH, the following policy, as per the Judicial Affairs website (http://students.georgiasouthern.edu/judicial/faculty.htm) will be enforced:

PROCEDURES FOR ADJUDICATING ACADEMIC DISHONESTY CASES
First Offense - In Violation Plea
1. If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is a first violation of academic dishonesty. The incident will be reported via the following website:
   http://students.georgiasouthern.edu/judicial/faculty.htm
2. If it is a first violation, the professor should talk with the student about the violation. If the student accepts responsibility in writing and the professor decides to adjudicate the case, the following procedures will be followed:
   a. The student will be placed on disciplinary probation for a minimum of one semester by the Office of Judicial Affairs.
   b. The student will be subject to any academic sanctions imposed by the professor (from receiving a 0 on the assignment to receiving a failing grade in the class).
   c. A copy of all the material involved in the case (Academic Dishonesty Report Form and the Request For Instructor to Adjudicate Form) and a brief statement from the professor concerning the facts of the case and the course syllabus should be mailed to the Office of Judicial Affairs for inclusion in the students discipline record.

First Offense - Not In Violation Plea (student does not admit the violation)
If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is the
first or second violation of academic dishonesty. The student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case. If the student is found responsible, the following penalty will normally be imposed:
a. The student will be placed on Disciplinary Probation for a minimum of one semester by the Office of Judicial Affairs.
b. The student will be subject to any academic sanctions imposed by the professor.

Second Violation of Academic Dishonesty
If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, and if it is determined this is the second violation, the student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case. If the student is found responsible, the following penalty will normally be imposed:
a. Suspension for a minimum of one semester or expulsion.
b. The student will be subject to any academic sanctions imposed by the professor.

NOT RESPONSIBLE FINDING
When a student is found not responsible of academic dishonesty, the work in question (assignment, paper, test, etc.) would be forwarded to the Department Chair. It is the responsibility of the Department Chair to ensure that the work is evaluated by a faculty member other than the individual who brought the charge and, if necessary, submit a final grade to the Registrar. For the protection of the faculty member and the student, the work in question should not be referred back to the faculty member who charged the student with academic dishonesty.

In the case of a Department Chair bringing charges against a student, an administrator at the Deans level will ensure that the students work is evaluated in an appropriate manner.

Academic Handbook: Students are expected to abide by the Academic Handbook, located at http://students.georgiasouthern.edu/sta/guide/. Your failure to comply with any part of this Handbook may be a violation and thus, you may receive an F in the course and/or be referred for disciplinary action.

University Calendar for the Semester: The University Calendar is located with the semester schedule, and can be found at: http://www.collegesource.org/displayinfo/catalink.asp.

Attendance Policy: Federal regulations require attendance be verified prior to distribution of financial aid allotments. Attendance will not be recorded after this initial period.

One Final Note: The contents of this syllabus are as complete and accurate as possible. The instructor reserves the right to make any changes necessary to the syllabus and course material. The instructor will make every effort to
inform students of changes as they occur. It is the responsibility of the student to know what changes have been made in order to successfully complete the requirements of the course.