CATALOG DESCRIPTION

STATISTICS IN APPLIED SCIENCE AND TECHNOLOGY

KNR 497 req.

Descriptive and inferential statistics in the applied sciences; statistical analysis using microcomputer applications.

OVERVIEW OF COURSE

This course introduces the student to descriptive and inferential statistics commonly used in research. Further, the student will utilize microcomputer applications as they relate to research, tests, measurements, and evaluation.

SPECIFIC COURSE GOALS

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

1. Identify appropriate statistical methods for testing various research hypotheses and questions.
2. Recognize violations and appropriate uses of basic descriptive and inferential statistical procedures.
3. Generate basic descriptive and inferential statistical procedures using microcomputer statistical software.
4. Interpret statistical output and present the results of statistical analyses in both scientific and non-scientific formats.
5. Interpret and evaluate results section of selected research articles.

TOPICAL OUTLINE

For each of the units outlined below, there will be a classroom experience that provides the theory and description of the statistical concepts, and a computer assignment to develop skill in application and interpretation of the concepts.

A. Introduction to the course
   1. Data description-descriptive and inferential statistics
   2. Values, variables, types of variables, types of data
   3. SPSS and course structure

B. Descriptive statistics
   1. Measures of central tendency and variability
   2. Assumptions of normal distribution and central tendency
   3. Testing for normality – histograms and frequency charts
   4. Implications for violations of assumptions

C. Association and prediction
   1. The model and its assumptions
   2. Scatterplots
3. Correlation  
4. Simple Linear Regression  
5. Multiple Linear Regression  
6. Path analysis  

D. Introduction to inferential statistics  
1. Hypothesis testing  
2. Type I and Type II Error, Power Analysis, Significance, Effect Size  
3. Constructing confidence intervals  
4. T-tests for independent observations and paired comparisons  

E. One-way analysis of variance  
1. Within and Between Group Variance  
2. Follow-up tests  

F. Factorial Analysis of Variance  
1. Basic Assumptions and Procedures for Violations of These Assumptions  
2. Main Effects and Interactions  
3. Follow-up Tests  

G. Repeated Measures Analysis of Variance  
1. Basic Assumptions and Procedures for Violations of These Assumptions  
2. Follow-Up Tests  

H. Nonparametric statistics (If time allows – it hasn’t in the last several occurrences of the class)

Required Texts:  
On-line (& free!): See external links section of course web site (Resources will be updated as the semester progresses. These resources will be valuable for you as theoretical background reading on each of the topics)

Required Student Tasks:  
You will be expected to complete each of the following:  
1. **Statistics computation and interpretation assignments.** You will be given roughly one assignment outside of class per week. These will comprise on-line quizzes designed to assess your grasp of both statistical methods and computer applications (and their interpretation). The exercises will be designed to introduce you to computational methods using SPSS, and interpretation of findings from published research articles. The latter will help you interpret results sections of published research. Assignments will be completed outside of classroom and instructed laboratory sessions. Students are encouraged to purchase a home version of the SPSS software provided in the laboratory. Please note that although the quizzes do play a part in your grade, you can take them as often as you like, so do keep going until you get 100%...that way it is a nice formative experience that should help both your understanding and your grade.  
2. **Class assignments:** Each week’s class will be used to discuss the various statistical tests listed on the course outline, give information about the theoretical basis of each statistical test, list examples of how each test would be appropriately used in the analysis of data, and provide practice opportunities in which you can learn how to complete the weekly out of class assignments.  
3. **Written Examinations.** One mid-term examination and a comprehensive final examination will be given to test students on their ability to identify assumptions, violations, appropriate uses, and interpretations of statistical procedures. Examinations will include both computational and interpretative exercises.

Evaluation Devices:
Weekly assignments (ReggieNet quizzes – often requiring SPSS interpretation) 20%
Midterm examination 40%
Final Examination 40%

Grading Scale:
90-100% A
80-89% B
70-79% C
60-69% D
0-59% F

Weekly schedule (TENTATIVE Dates included))

<table>
<thead>
<tr>
<th>Week</th>
<th>SPSS &amp; Class Topics</th>
<th>Cronk</th>
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<tbody>
<tr>
<td>1 (1.11)</td>
<td>SPSS: Getting started, entering &amp; modifying data&lt;br&gt;Class: Introduction - Description and inference; Values and variables; Measurement scales</td>
<td>Ch.'s 1 &amp; 2</td>
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<tr>
<td>1.18</td>
<td><strong>No class – MLK day</strong></td>
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<tr>
<td>2 (1.25)</td>
<td>Descriptive statistics:&lt;br&gt;<em>Measures of central tendency and dispersion</em>&lt;br&gt;<em>z</em>-scores (standard scores); Graphing data</td>
<td>Ch. 3, Ch.4</td>
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<tr>
<td>3 (2.1)</td>
<td>Prediction and association I:&lt;br&gt;<em>Correlation &amp; Multiple Correlation</em></td>
<td>Ch.5.1, 5.2</td>
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<tr>
<td>4 (2.8)</td>
<td>Prediction and association II:&lt;br&gt;<em>Simple Linear Regression</em></td>
<td>Ch.5.3</td>
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<tr>
<td>5 (2.15)</td>
<td>Prediction and association III:&lt;br&gt;<em>Testing assumptions of Regression</em></td>
<td>Ch.5.3</td>
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<tr>
<td>6 (2.22)</td>
<td>Prediction and association IV:&lt;br&gt;<em>Multiple Linear Regression</em></td>
<td>Ch.5.4</td>
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<tr>
<td>7 (2.29)</td>
<td>Prediction and association V:&lt;br&gt;<em>Model reduction</em></td>
<td>Ch.5.4</td>
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<td>8 (3.7)</td>
<td><strong>No class – Spring Break</strong></td>
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<tr>
<td>9 (3.14)</td>
<td>Midterm: Take home portion due tonight, multiple choice version will be completed tonight.</td>
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<tr>
<td>10 (3.21)</td>
<td>Inferential statistics I:&lt;br&gt;<em>Hypothesis testing</em></td>
<td>Ch. 6.1-6.4</td>
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<tr>
<td>11 (3.28)</td>
<td>Inferential statistics II:&lt;br&gt;<em>Three types of t-test</em></td>
<td>Ch. 6.1-6.4</td>
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<tr>
<td>12 (4.4)</td>
<td>Inferential statistics III:&lt;br&gt;<em>1-way ANOVA; power; effect size</em></td>
<td>Ch. 6.5</td>
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<tr>
<td>13 (4.11)</td>
<td>Inferential statistics IV:&lt;br&gt;<em>Factorial ANOVA</em></td>
<td>Ch. 6.6</td>
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<td>14 (4.18)</td>
<td>Inferential statistics V:&lt;br&gt;<em>Repeated Measures &amp; Mixed ANOVA; follow-up tests</em></td>
<td>Ch. 6.7-6.8</td>
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<td>15 (4.25)</td>
<td><strong>Review for final</strong></td>
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<td>16 (5.2)</td>
<td><strong>FINAL (5.30pm)</strong></td>
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# Course Policies, Procedures, and Other Resources

**Academic Integrity**

General Statement from The Office of the Dean of Students (Endorsed by me):

Academic integrity is an important part of this university and the course. Academic integrity is required of you the student and myself as the instructor. Students are expected to be honest in all academic work. It is the student’s and faculty’s responsibility to uphold the principles of academic integrity. Academic integrity should be used in the preparation of this course, in class time, regarding exams, and with regard to written assignments. A student’s placement of his or her name on any academic exercise shall be regarded as assurance that the work is the results of the student’s own thought, effort and study.

Students who have questions regarding issues of academic dishonesty should refer to the Code of Student Conduct, B1 (Academic Integrity), which outlines unacceptable behaviors in academic matters. In certain circumstances (such as cheating or plagiarism), I may be required to refer a student to Community Rights and Responsibilities for a violation of Illinois State University’s Code of Student Conduct. If you are uncertain about whether or not something is dishonest, please contact me (peter.smith@ilstu.edu). Academic penalties regarding academic dishonesty may range from failure of the assignment (with a zero for the piece of work) to dismissal from the University, depending upon the seriousness of the infraction and the student’s disciplinary record.

Link to code of student conduct:

Other issues relevant to this course:

**Plagiarism:** Any work submitted should be your own. Any evidence of plagiarism, or of academic dishonesty of any kind, will result in the **minimum penalty of a zero** for the relevant part of the course. For further information, see student code of conduct (linked above). *Please note this only applies to the midterm and final.* All quizzes on ReggieNet and class work are designed and intended to be shared work.

**Late submissions**

Documentary evidence must be submitted to excuse any missed assignment, including exams/quizzes. If you miss without giving me prior warning, you will be likely to receive zero on the assignment.

In general, late submissions of the **take home exams** will be penalized by 10% of the grade for the assignment for each day or part of day that they are late. For instance, if you are late by 1 hour you will be docked 10% of the grade (a grade of 76% will become 66%); if you are late by 25 hours (more than one day), you will be docked 20% of the grade (a grade of 76% will become 56%), and so on. **Late submissions of quizzes will automatically receive a zero.** Don’t miss them!

**For additional information and help...**

*The Julia N. Visor Academic Center, a division of University College, provides the following free services for students:*

- Tutoring in a variety of academic subject areas, including support for many of the courses in the Inner Core of the General Education program.
- One-on-one writing assistance to anyone in the University community.
  Appointments can take place in the Visor Center or on Skype.*
• Study skills assistance individually and in small groups, as well as study skills workshops, for students who want to improve their ability to achieve academic success.

• A variety of academic support programs targeted to help students achieve their full academic potential.

    The Julia N. Visor Academic Center
    438-7100
    Vrooman 012 (between Manchester and Hewett dorms)
    Mon-Thurs, 8:00 a.m.-9:00 p.m., Fri, 8:00 a.m.-4:30 p.m., Sun, 4:00 p.m.-8:00 p.m.
    www.UniversityCollege.IllinoisState.edu/tutoring

**Disability concerns:** Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TTY).