ST 437: Applied Multivariate and Longitudinal Data Analysis

In Workflow

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12. COS Final Review GR (clbowma2@ncsu.edu; alun_lloyd@ncsu.edu)
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27. PeopleSoft (none)

Approval Path

1. Tue, 01 Mar 2016 23:40:27 GMT
   Spencer Muse (muse): Approved for 17ST UG Director of Curriculum
2. Wed, 02 Mar 2016 01:44:38 GMT
   Donald Martin (demarti4): Approved for 17ST GR Director of Curriculum
3. Wed, 02 Mar 2016 02:33:54 GMT
   Montserrat Fuentes (fuentes): Approved for 17ST UnderGrad Head
4. Wed, 02 Mar 2016 02:35:32 GMT
   Montserrat Fuentes (fuentes): Approved for 17ST Grad Head
5. Wed, 02 Mar 2016 14:40:59 GMT
   Cheryll Bowman-Medhin (clbowma2): Approved for COS CC Coordinator UG
6. Thu, 03 Mar 2016 13:44:08 GMT
   Cheryll Bowman-Medhin (clbowma2): Approved for COS CC Meeting UG
7.Tue, 20 Sep 2016 20:05:58 GMT
   Gregory Neyhart (Greg_Neyhart): Approved for COS CC Chair UG
8. Tue, 20 Sep 2016 22:23:22 GMT
   Jo-Ann Cohen (cohen): Approved for COS Dean UG
   Cheryll Bowman-Medhin (clbowma2): Approved for COS CC Coordinator GR
10. Wed, 21 Sep 2016 13:06:01 GMT  
   Cheryll Bowman-Medhin (clbowma2): Approved for COS CC Meeting GR
11. Mon, 21 Nov 2016 15:35:23 GMT  
   Alun Lloyd (alun_lloyd): Approved for COS CC Chair GR
   Cheryll Bowman-Medhin (clbowma2): Approved for COS Final Review GR
13. Mon, 21 Nov 2016 17:35:38 GMT  
   William Ditto (wditto): Approved for COS Dean GR
14. Mon, 05 Dec 2016 15:35:08 GMT  
   Alun Lloyd (alun_lloyd): Approved for allloyd
15. Mon, 05 Dec 2016 21:18:01 GMT  
   Alexandra Hergeth Huggins (aehlerget): Approved for OUCC Review
16. Tue, 13 Dec 2016 15:09:11 GMT  
   Alexandra Hergeth Huggins (aehlerget): Approved for UCCC Coordinator
   Li Marcus (lamarcus): Approved for UCCC Meeting
18. Wed, 14 Dec 2016 20:02:09 GMT  
   Andrew Nowel (nowel): Approved for UCCC Chair
19. Thu, 29 Dec 2016 19:04:56 GMT  
   Barbara Kirby (barbara_kirby): Approved for OUCC Final Signature
20. Tue, 03 Jan 2017 15:42:34 GMT  
   Li Marcus (lamarcus): Approved for OUCC Final Review
21. Tue, 10 Jan 2017 23:15:50 GMT  
   Dennis Boos (boos): Approved for boos
   Peter Harries (pjarrie): Approved for ABGS Coordinator
23. Wed, 15 Feb 2017 16:52:54 GMT  
   Dennis Boos (boos): Approved for boos
   Melissa Nosbisch (mnosbis): Approved for ABGS Meeting

**New Course Proposal**

*Date Submitted: Wed, 17 Feb 2016 18:14:24 GMT*

**Viewing: ST 437/ST 537 : Applied Multivariate and Longitudinal Data Analysis**

Changes proposed by: boos

**Change Type**

Major

**Course Prefix**

ST (Statistics)

**Course Number**

437

**Dual-Level Course**

Yes

**Dual-Level Course Number:**

537

**Cross-listed Course**

No
Title
Applied Multivariate and Longitudinal Data Analysis

Abbreviated Title
Mult. and Long. Data Analysis

College
College of Sciences

Academic Org Code
Statistics (17ST)

CIP Discipline Specialty Number
27.0501

CIP Discipline Specialty Title
Statistics, General.

Term Offering
Spring Only

Year Offering
Offered Every Year

Effective Date
Spring 2017

Previously taught as Special Topics?
Yes

Number of Offerings within the past 5 years
1

Course Prefix/Number
ST 495/ST 590

Semester/Term Offered
Spring 2016

Enrollment
495-4, 590-29

Course Delivery
Face-to-Face (On Campus)
Distance Education (DELTA)
Online (Internet)

Grading Method
Graded with S/U option

Credit Hours
3

Course Length
16 weeks

Contact Hours
Component Type | Contact Hours
---|---
Lecture | 3

Course Attribute(s)

Course Is Repeatable for Credit

No

Instructor Name

Ana-Maria Staicu

Instructor Title

Associate Professor

Grad Faculty Status

Full

Anticipated On-Campus Enrollment

Open when course_delivery = campus OR course_delivery = blended OR course_delivery = flip

<table>
<thead>
<tr>
<th>Enrollment Component</th>
<th>Per Semester</th>
<th>Per Section</th>
<th>Multiple Sections?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>10</td>
<td>10</td>
<td>No</td>
<td>We expect up to 30 in the graduate version, ST 537, in the same classroom.</td>
</tr>
</tbody>
</table>

DELTA/Online Enrollment:

Open when course_delivery = distance OR course_delivery = online OR course_delivery = remote

<table>
<thead>
<tr>
<th>Delivery Format</th>
<th>Per Semester</th>
<th>Per Section</th>
<th>Multiple Sections?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEC</td>
<td>10</td>
<td>10</td>
<td>No</td>
<td>graduate version online</td>
</tr>
</tbody>
</table>

Course Prerequisites, Corequisites, and Restrictive Statement

ST 437: P: ST 422 and ST 430
ST 537: P: ST 512 or ST 514 or ST 515 or ST 517

Is the course required or an elective for a Curriculum?

No

Catalog Description

An introduction to use of statistical methods for analyzing multivariate and longitudinal data collected in experiments and surveys. Topics covered include multivariate analysis of variance, discriminant analysis, principal components analysis, factor analysis, covariance modeling, and mixed effects models such as growth curves and random coefficient models. Emphasis is on use of a computer to perform statistical analysis of multivariate and longitudinal data.

Justification for new course:

The course is designed to expose students to the analysis of multivariate data (multiple variables or traits measured for the same individual) and longitudinal data (same variable or trait measured repeatedly on individuals over time). The course will be primarily focused on exposure to and practical implementation of various statistical concepts and methodology to analyze such data sets. There were previously two courses covering this material: ST 731 Applied Multivariate Statistics Analysis and ST 732 Longitudinal Data Analysis. We decided to combine these two courses in order for students to get some of both courses in one course. A new course proposal will be submitted in the future to make ST 732 a PhD level course. There are no plans for ST 731.

Does this course have a fee?

No
Is this a GEP Course?
No

Consultation

Instructional Resources Statement
Dr. Staicu will teach the course as part of her standard teaching obligation, thus no new resources are required.

Course Objectives/Goals
Students will gain a basic competency in statistical analysis of multivariate and longitudinal data sets. They will be able to use SAS or R to carry out these analyses. Students will learn to interpret the output from these programs and be able to integrate those results into their research publications.

Student Learning Outcomes

By the end of the course, the students will be able to:

(1) select, carry out, and interpret appropriate statistical methods for describing and analyzing multivariate/longitudinal data sets in the context of their own research interests; (2) explain a full range of multivariate/longitudinal data analysis methods and their use and limitations in a research context, and (3) examine critically their own and other researchers use of methods of analysis for multivariate and longitudinal data.

ST 537 Only: Demonstrate the ability to work with more theoretical aspects of selected topics via derivations, proofs, or other more advanced statistical techniques

Student Evaluation Methods

<table>
<thead>
<tr>
<th>Evaluation Method</th>
<th>Weighting/Points for Each</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>40%</td>
<td>537 students will have additional HW problems that address the additional learning outcomes for graduate students.</td>
</tr>
<tr>
<td>Midterm</td>
<td>30%</td>
<td>Closed book, closed notes. ST 537 students will have additional Exam questions that address the additional learning outcomes for graduate students.</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
<td>Closed book, closed notes. ST 537 students will have additional Exam questions that address the additional learning outcomes for graduate students.</td>
</tr>
</tbody>
</table>

Topical Outline/Course Schedule

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time Devoted to Each Topic</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Basic Concepts</td>
<td>2 weeks</td>
<td>(a) Examples of a few multivariate and longitudinal data sets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Review of vectors and matrices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Review of common distributions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(d) Review of common summary statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(e) Basic regression models</td>
</tr>
<tr>
<td>Inference about mean vectors</td>
<td>2 weeks</td>
<td>#i. Inference about a single mean vector (Hotelling's T^2, Likelihood ratio test, simultaneous confidence intervals)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Inference about multiple mean vectors (paired comparison, repeated measured design, MANOVA, profile analysis)</td>
</tr>
<tr>
<td>Principal Components Analysis</td>
<td>1 week</td>
<td>Principal Components Analysis</td>
</tr>
<tr>
<td>Course</td>
<td>Duration</td>
<td>Topics</td>
</tr>
<tr>
<td>--------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Factor Analysis</td>
<td>3 weeks</td>
<td>i. Orthogonal factor model and estimation (PCA based method, likelihood based method) ii. Factor rotation and factor scores iii. Classification and clustering</td>
</tr>
<tr>
<td>General Linear Models</td>
<td>2 weeks</td>
<td>i. Parametric mean model ii. Models for covariance iii. Inference by maximum likelihood iv. Restricted maximum likelihood</td>
</tr>
<tr>
<td>Linear Mixed models</td>
<td>2 weeks</td>
<td>i. Growth curves ii. Random coefficient model. Estimation of regression and covariance parameters iii. Linear mixed effects model. Estimation, inference, and prediction</td>
</tr>
<tr>
<td>Final Exam</td>
<td>1 week</td>
<td></td>
</tr>
</tbody>
</table>

**Syllabus**

ST_437-537_feb15_2017.pdf

**Additional Documentation**

**Additional Comments**

ST 437 and 537 will differ in the following way. 537 will have an additional learning outcome: Demonstrate the ability to work with more theoretical aspects of selected topics via derivations, proofs, or other more advanced statistical techniques. 537 students will have additional HW and Exam questions to evaluate this learning outcome.

minosbis 1/10/2017: No overlapping courses outside of ST, no consultation required. 1) Expand justification to address how this differs from ST 731 and 732. 2) Has this been previously taught as special topics? What are the previous enrollment numbers?

ABGS Reviewer Comments:
-Do we want additional detail about the additional homework and additional exam questions for the 500-level? It seems that in the past we have asked for clearer articulation.

pjharrie 1/31/2017 I think the more clearly the differences between 400/500 levels are articulated, the better. So, I feel that the ABGS Reviewer comments should be addressed.

**Course Reviewer Comments**

muse (Tue, 04 Aug 2015 16:49:11 GMT): This should be marked as a Dual-Level Course


lamarcus (Fri, 05 Feb 2016 21:42:39 GMT): Rollback: Rolled back at instructor request

allloyd (Mon, 21 Nov 2016 15:38:55 GMT): Passed college committee 11/11/16

Key: 7238