Instructor/TA Info

Instructor Information

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TA Information

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Course Information

Description

This is a graduate level course in applied multivariate statistics. I expect that students who take this class are already comfortable with applications of general linear modeling with univariate statistics such as ANOVA and multiple regression. This class will build on that foundation by introducing the multivariate cousins of these statistics. We will also cover confirmatory factor analysis, structural equation modeling and latent growth curve modeling.

Materials

	Item	Price (new)	Price (used)
	PRIN & PRAC OF STRUCTURAL EQUATION MODELING - *Required* by KLINE, R	65.00	48.75

Learning Outcomes

1. Read and understand statistical methods
Students will be able to read and understand the statistical methods in virtually any empirical article.
Measurement: This will be measured by quizzes and exams.
2. Select appropriate methods
Students will know what statistical tests to use to answer specific research questions.
Measurement: This will be measured by quizzes and exams.
3. Statistical software use and interpretation
Students will be able to perform—using statistical software—interpret, and write up for publication the results of the multivariate statistical tests most commonly used in psychological science.
Measurement: This will be measured by performance on a group course project, and also on exams.

Grading Scale

Grades	Percent
A	93%
A-	90%
B+	87%
B	83%
B-	80%
C+	77%
C	73%
C-	70%

D+	67%
D	63%
D-	60%
E	0%

Grading Policy

Quizzes: Quizzes will be administered throughout the semester covering the text, discussion, and assigned readings. These will be given during the first 30-60 minutes of class on the day they are scheduled in the syllabus.
Homework: To get good at data analysis, you have to do data analysis. It's not enough to read about statistical theory, or talk about these principles in the abstract--to really learn, you have to run lots of analyses and deal with the messiness of real data. Homework assignments will typically be begun in class, and then finished on your own (including write up of the analyses at home). A typical homework assignment include writing a brief results section from an analysis we worked through in class.
Course Project: The best way to evaluate performance and learning is across domains and not solely through examinations. As such, you will be asked to pre-register a study design, carry out the analysis, and write an empirical paper as if for publication in a brief report format. This will allow you to actively apply the concepts learned in this course in a practical, applied way (that will hopefully lead to an additional publication for you). You will need to obtain data (whether from an existing dataset or a published article) and use one of the techniques taught in class to answer a research question of your choosing.

Classroom Procedures

General Decorum: Arriving late to class, leaving early, sleeping, texting, surfing the internet, doing homework in class, etc. is distracting and disrespectful to all of us. Don't do that.

Schedule

Date	Topic	Assignments
Week 1		
W Sep 06 Wednesday	Course Description and Introduction **Review of Important Concepts Opens**	
Week 2		
M Sep 11 Monday	Why Multivariate Statistics? Rough Guide to Statistical Techniques	Kline Chapter 1 "Coming of Age"
W Sep 13 Wednesday	Seminar Discussion: Getting it right. There replication crisis in psychology and science more broadly. OSF Preregistration Assignment	**Come prepared to lead a discussion with one discussion question for each of the four articles (so four questions total). The discussion questions should be designed to incite discussion, not to test for knowledge of facts in the articles. You will post your questions in Digital Dialogue before class. Reading the articles early and posting your question early is advantageous since the "low hanging fruit" questions might be plucked by the early birds.** Ioannidis Why Most Findings Are False.pdf Download False-Positive Psychology.pdf Download ReproducibilityofPsychScience.pdf Download Perspectives on Psychological Science-2012-Nosek-615-31.pdf Download Preregistration_Template_V05.docx Download Reviewer_instructions.docx Download
Week 3		

M Sep 18 Monday	Data Preparation **Low-stakes quiz 1 Opens**	Kline Chapter 4 "Data Preparation and Psychometrics Review" 502_Data Cleaning Example.dta Download 502_data screening.do Download
W Sep 20 Wednesday	Data Preparation	Warner Applied Statistics "Reliability, Validity, and Multiple-Item Scales" 502_Self Esteem Depression.dta Download 502_self esteem depression.do Download
F Sep 22 Friday	**Review of Important Concepts Closes**	
Su Sep 24 Sunday	**Low-stakes quiz 1 Closes**	
Week 4		
M Sep 25 Monday	**Quiz 1: Fundamental Concepts and Data Preparation** Measurement: Intro and Cronbach's Alpha	
T Sep 26 Tuesday	**Homework 1: Data Screening**	
W Sep 27 Wednesday	Measurement: Exploratory Factor Analysis	Warner Applied Statistics "Principal Components and Factor Analysis"
Week 5		
M Oct 02 Monday	EFA: Extraction and Rotation **Low-stakes quiz 2 Opens**	
W Oct 04 Wednesday	Intro to Path Analysis/CFA/SEM	Kline Chapter 6 "Specification of Observed Variable (Path) Models" Hamilton.xls Download
F Oct 06 Friday	**Homework 2: EFA**	
Su Oct 08 Sunday	**Low-stakes quiz 2 Closes**	
Week 6		
M Oct 09 Monday	**Quiz 2: EFA & Measurement** Path Analysis Work Through	An example of excellent Methods/Results write up of path analysis example
W Oct 11 Wednesday	Commonly Used Model: Cross-lagged panel design Slowly Making Friends with CFA	502_cross-lag.do Download WAI_Client.pdf Download data_alliance_onefactor.sav Download
F Oct 13 Friday	**Introduction & Items 1-3 of Preregistration**	
Week 7		
M Oct 16 Monday	CFA: Fundamental Equation **Low stakes quiz 3 Opens**	Kline Chapter 7 "Identification of Observed-Variance (Path) Models" (you may stop reading when you reach "Identification of Non-recurisve Models") CFA Matrix Algebra Exercise.xlsx Download
W Oct 18 Wednesday	CFA: Fit (χ^2) and Identification	Kline Chapter 9 " Specification and Identification of Confirmatory Factor Analysis Models" data_sedep_cfa.sav Download
F Oct 20 Friday	**Homework 3: CFA One Factor**	

Su Oct 22 Sunday	**Low stakes quiz 3 Closes**	
Week 8		
M Oct 23 Monday	**Quiz 3: CFA One Factor** CFA: How Well Does My Model Fit the Data?	Kline Chapter 12 "Global Fit Testing"
W Oct 25 Wednesday	Writing up results in SEM/CFA	Interpreting and Writing Results_Student File.do Download
Week 9		
M Oct 30 Monday	**Presentation of Course Project** Project Proposal Presentations	
W Nov 01 Wednesday	Project Proposal Presentations	
F Nov 03 Friday	**Method and 4-16 of Preregistration**	
Week 10		
M Nov 06 Monday	**Low-stakes quiz 4 Opens** Structural Equation Modeling	Kline Chapter 10 "Specification and Identification of Structural Regression Models"
W Nov 08 Wednesday	Structural Equation Modeling--Mediation	Shrout and Bolger (2002) mediation example.xls Download
F Nov 10 Friday	**Homework 4: SEM Wheaton Dataset**	
Su Nov 12 Sunday	**Low-stakes quiz 4 Closes**	
Week 11		
M Nov 13 Monday	**Quiz 4: SEM** In Class Lab on Pre-registration	
W Nov 15 Wednesday	ABCT New York--No Class (Boo! Hiss!)	
F Nov 17 Friday	**Complete Preregistration DONE (Items 17-26) and registration entered into OSF**	
Week 12		
M Nov 20 Monday	No Class - Happy Thanksgiving!	
T Nov 21 Tuesday	**Friday Instruction**	
W Nov 22 Wednesday	**No Classes**	
Th Nov 23 Thursday	**Thanksgiving**	
F Nov 24 Friday	**Thanksgiving Holiday** **Homework 5: SEM Mediation**	
Week 13		
M Nov 27 Monday	In Class Stats Party: Bring Project Data to Work On	
W Nov 29 Wednesday	In Class Stats Party: Bring Project Data to Work On	
F Dec 01 Friday	**Results Section 1st Draft**	
Week 14		

M Dec 04 Monday	Stuctural Equation Modeling--Moderation **Low-stakes quiz 5 Opens**	Kline Chapter 17 " Interaction Effects and Multilevel Structural Equation Modeling" (no need to read the Multilevel SEM section for this class) moderation_fall 2014.do Download
W Dec 06 Wednesday	Stuctural Equation Modeling--Moderation	
F Dec 08 Friday		
Su Dec 10 Sunday	**Low-stakes quiz 5 Closes**	
Week 15		
M Dec 11 Monday	**Quiz 5: SEM part 2** In Class Peer Review	Bring Draft of Results Section for Peer Review
W Dec 13 Wednesday	Structural Equation Modeling--Latent Growth	Kline Chapter 15 "Mean Structures and Latent Growth Models" latentgrowth.do Download LGC Example Data.dta Download
Week 16		
M Dec 18 Monday	**Intro, Method & Results Section 2nd Draft (Course Final)** Final Exam: 102 SWKT 7:00am - 10:00am	

Assignments

Assignment Description

Review of Important Concepts

Sep 22 Due: Friday, Sep 22 at 11:59 pm

Closed book, online quiz designed to ensure that you have learned key principles from your previous statistics courses. Reviewing Chapters 2 and 3 of Kline will help to shore up any areas of weakness. But don't worry about the content of Ch. 3 on noncentral test distributions and bootstrapping. You can take it as many times as you want before you "pass" (achieve a score of 80% or better). BUT for each time you take the exam, 3 points are deducted from your passing score so it behooves you to study and pass it on the first or second try.

Low-stakes quiz 1

Sep 24 Due: Sunday, Sep 24 at 11:59 pm

If you get all five questions correct, you can earn 1 point of extra credit.

Quiz 1: Fundamental Concepts and Data Preparation

Sep 25 Due: Monday, Sep 25 at 10:00 am

This quiz assesses learning on fundamental concepts and data preparation.

Homework 1: Data Screening

Sep 26 Due: Tuesday, Sep 26 at 10:00 pm

502_HW1_Data Screening Homework.docx Download (plugins/Upload/fileDownload.php?fileId=09d33471-ftsa-fdSl-LwXR-h984a0f8ad56&pubhash=-zC01rZsKN9lghe0RT3HBVYjDMI5wnRcCwWND3pHkpYeLA1oJ1mt5haoBXC9jCiH7_1p7B8vFnsvpxkRTmLung==)
Here's the data set 502_Data Screening Homework.dta Download (plugins/Upload/fileDownload.php?fileId=99ff0661-tDzz-aWXa-WCPX-Hn1ab9f098eb&pubhash=XQCwz7gOmNMX3ymJgBWEe-o-VDP_xd-TBodG9dOffaCLGrby7XYNtmRTkRivGOri8wakOWje2ddO9QMOg2mnzQ==)

Homework 2: EFA

Oct 06 Due: Friday, Oct 06 at 11:59 pm

EFA Homework_Fall 2016.docx Download (plugins/Upload/fileDownload.php?fileId=aca122a2-JQTg-GeNQ-dACD-vf8a5c7cc10c&pubhash=z6_WlnV8aN2oZ1DPETZK8pcEdooRx46_Wu3MT4TOrzjYjILQx66i0BZVPo8vBMGNZyskOrLumL_QTGw_94l3AA==)
data_efa_alliance.dta Download (plugins/Upload/fileDownload.php?fileId=684ebcb1-RX5M-kt6s-tgAw-ia080bb3833c&pubhash=0-OymYw-XIuGmBBV4miq4x0UMmsIcLvikOxGKJubbPeMj3lw9F32emJM6eD3kHE9qCE7ioa_4a_WRYI2B4n9FQ==)
WAI_Client.pdf Download (plugins/Upload/fileDownload.php?fileId=a9173827-omCT-dwFx-jfkM-znea6f5b31b3&pubhash=D2TiljgnEsL4a-UQYPfNoRbasca158ZvPJaaU8q_DvbSmQVUdNH2WLT6H_7U4E3BMnBcoBefSxRXH9voLbcalw==)

Low-stakes quiz 2

Oct 08 Due: Sunday, Oct 08 at 11:59 pm

Choose the best answer for each question. Do your darndest.

Quiz 2: EFA & Measurement

Oct 09 Due: Monday, Oct 09 at 12:00 pm

EFA & Measurement Quiz

Introduction & Items 1-3 of Preregistration

Oct 13 Due: Friday, Oct 13 at 11:59 pm

Process—

- Critically read sources related to your project
- Formulate a research question that you hope to address
- Talk to your advisor (or others who may have access to data relevant to your research question) about what data might be available that is relevant to your research question
    - Keep in mind that many multivariate methods allow you to use published means and correlation matrices as data
- Create a A brief report length (2-4 pages of double spaced text) introduction with all APA conventions including references. References and tables do not count toward page count. Be sure to provide a compelling rationle for
    - the need for your proposed study
    - how your study is a clearly indicated "next step" for the existing body of research
- And make sure to include
    - a clearly defined research question (or questions) that arises from existing research
    - A priori hypotheses

Homework 3: CFA One Factor

Oct 20 Due: Friday, Oct 20 at 11:59 pm

CFA Homework Winter 2014_Word Export.docx Download (plugins/Upload/fileDownload.php?fileId=3a6d8497-6Yxh-L6DL-oQAC-kV2f6190cfad&pubhash=SpKpMdsff7p2OP-ZMJS8AY0pW9gtuDNRejJ1wd6AumzXD5Uh-ieF_t8s431j_avzGariL1FVyMeTEDxX-SPVlQ==)

data_cohesion_onefactor.dta Download (plugins/Upload/fileDownload.php?fileId=ebc6bc77-hza9-uGmw-J2wQ-N2b5609c785b&pubhash=aZPc4MO7HNiFQ9dsQExqK3UEhNP2QDW8hiq0rl1oXSTD3ByQSMPLRkpbNeg3EZG8CoaYEP6HB5r_YlqVRkVNaQ==)

Low stakes quiz 3

Oct 22 Due: Sunday, Oct 22 at 11:59 pm

If you get all five questions correct, you get one extra credit point. It's so fun!

Quiz 3: CFA One Factor

Oct 23 Due: Monday, Oct 23 at 10:00 am

In class quiz

Presentation of Course Project

Oct 30 Due: Monday, Oct 30 at 11:59 pm

You will prepare a presentation of a proposal of your project (similar to what you would do for a prospectus, but shorter). You will have about 10 minutes for your presentation and a few minutes for questions. It is important that you give yourself enough time to really walk us through the methods. Don't spend much time on introducing your topic at a broad level (a common mistake). By focusing on the method (including measurement!), we as an audience will be better able to determine whether your methods allow you to ask the research question you are interested in.

Method and 4-16 of Preregistration

Nov 03 Due: Friday, Nov 03 at 11:59 pm

Use the APA manual as your guide for this and all other sections of the paper. But in particular I will be looking for whether you adequately described participants (including recruitment procedures), study procedures (can I replicate your study based on what is written?), and methods of measurement (did you provide evidence for reliability and validity?).

Homework 4: SEM Wheaton Dataset

Nov 10 Due: Friday, Nov 10 at 11:59 pm

SEM Wheaton HW 2014.docx Download (plugins/Upload/fileDownload.php?fileId=4d2ccc19-NuNA-5qn1-bsZw-Xn21fda5bc68&pubhash=8I9qksywD1tWYeVfWssY0nVpcuJ5DfSkfXsRBjBS6oMjvjVTf1L1BPpqU_pxlDbeXL_XSJ8EJ_cNAlMXejuCWA==)
Datset (copy and paste the code below into your .do file):
use http://www.stata-press.com/data/r12/sem_sm2.dta, clear

Low-stakes quiz 4

Nov 12 Due: Sunday, Nov 12 at 11:59 pm

Choose the best answer. Make us proud.

Quiz 4: SEM

Nov 13 Due: Monday, Nov 13 at 10:00 am

Do or do not; there is no try.

Complete Preregistration DONE (Items 17-26) and registration entered into OSF

Nov 17 Due: Friday, Nov 17 at 11:59 pm

Homework 5: SEM Mediation

Nov 24 Due: Friday, Nov 24 at 11:59 pm

mediation example.xls Download (plugins/Upload/fileDownload.php?fileId=5611110f-Eecq-GV2C-KU8e-vE221c21e83a&pubhash=_wQSxAHn4ahLjMuR4-yDzinILaCW9yIOTeQGu9SRcEtiyeKB8MJd5_i-lwScjANlnR5BiK0HTJox6kKomNtlSg==)
In Class SEM Homework.docx Download (plugins/Upload/fileDownload.php?fileId=d547c370-APCw-pv4W-cFHQ-8d389b0a9c0a&pubhash=UcAIo1s_zU07Wyz3mrmgTfQJXWtdY4vjvJhRsPPUVGMehc-bpTmistIUvH3Yj5LpKtvTZ7tTpc_lQtDTusp8Gg==)

Results Section 1st Draft

Dec 01 Due: Friday, Dec 01 at 11:59 pm

I have designed this course with specific outcomes in mind; two of them are that you will "know what statistical tests to use to answer specific research questions" (Learning Outcome 2) and "be able to perform—using statistical software—interpret, and write up for publication the results of the multivariate statistical tests most commonly used in psychological science" (Learning Outcome 3). This assignment provides the opportunity for you to develop these skills in a way that passively listening to lectures can't match.
Process—

- Consult the text, your class notes, your peers, your advisor, the TA and Dr. Braithwaite about the most appropriate statistical approaches to asking your research question of your data
    - Keep in mind, though, that you need to use one of the new multivariate techniques from 502
- Conduct the analyses
- Write a draft of your results section
- Share the draft with helpful people—people who will give you helpful (i.e. critical) feedback—your peers, the folks as the FHSS Writing Lab, etc.
- Revise the paper
- Share the draft with helpful people—people who will give you helpful (i.e. critical) feedback—your peers, the folks as the FHSS Writing Lab, etc.
- Revise the paper
- Share the draft with helpful pe… you get the idea

Be sure to include the following elements:

- Data Analysis Section: This is where you describe your analytic approach and convince the reader that it is the best approach for your particular research question.
- A discussion of treatment of data prior to analyses (esp. in light of assumptions of analysis)

And make sure that you correctly use and interpret statistics and provide a clear connection between results and study hypotheses/aims.

Low-stakes quiz 5

Dec 10 Due: Sunday, Dec 10 at 11:59 pm

It is a truth universally acknowledged that a single student in possession of a stats package must be in want of a moderated mediation.

Quiz 5: SEM part 2

Dec 11 Due: Monday, Dec 11 at 10:00 am

Rejoice and give thanks, for the semester is almost over.

Intro, Method & Results Section 2nd Draft (Course Final)

Dec 18 Due: Monday, Dec 18 at 11:59 pm

Process—

- After receiving feedback from the TA, professor, your peers and (hopefully) your research advisor, and revising your paper multiple times in response to feedback from each of these sources, you will now have a polished, publication ready manuscript (sans discussion).

Grading--so you can see how we will evaluate your paper, see the grading rubric attached below.
_____ /20 Data Analysis Section: This is where you describe your analytic approach and convince the reader that it is the best approach for your particular research question.
_____ /10 Treatment of data prior to analyses (esp. in light of assumptions of analysis)
_____ /40 Correct use of and interpretation of statistics. Clearly describe what analyses were part of the preregistration and label other analyses, if any, as post-hoc.
_____ /20 Clear connection between results and study hypotheses/aims
_____ /10 APA style (including clarity/precision/economy of language, etc.)

Total: _____ /100

University Policies

Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and every instructor's expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Sexual Misconduct

In accordance with Title IX of the Education Amendments of 1972, Brigham Young University prohibits unlawful sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment-including sexual violence-committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university.

University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at t9coordinator@byu.edu or (801) 422-8692. Reports may also be submitted through EthicsPoint at https://titleix.byu.edu/report (https://titleix.byu.edu/report) or 1-888-238-1062 (24-hours a day).

BYU offers confidential resources for those affected by Sexual Misconduct, including the university's Victim Advocate, as well as a number of non-confidential resources and services that may be helpful. Additional information about Title IX, the university's Sexual Misconduct Policy, reporting requirements, and resources can be found at http://titleix.byu.edu (http://titleix.byu.edu) or by contacting the university's Title IX Coordinator.

Student Disability

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.

Inappropriate Use Of Course Materials

All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, PowerPoint presentations, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course. To do so is a violation of the Brigham Young University Honor Code.