Research Design and Analysis I

EDUC/PSY 6600

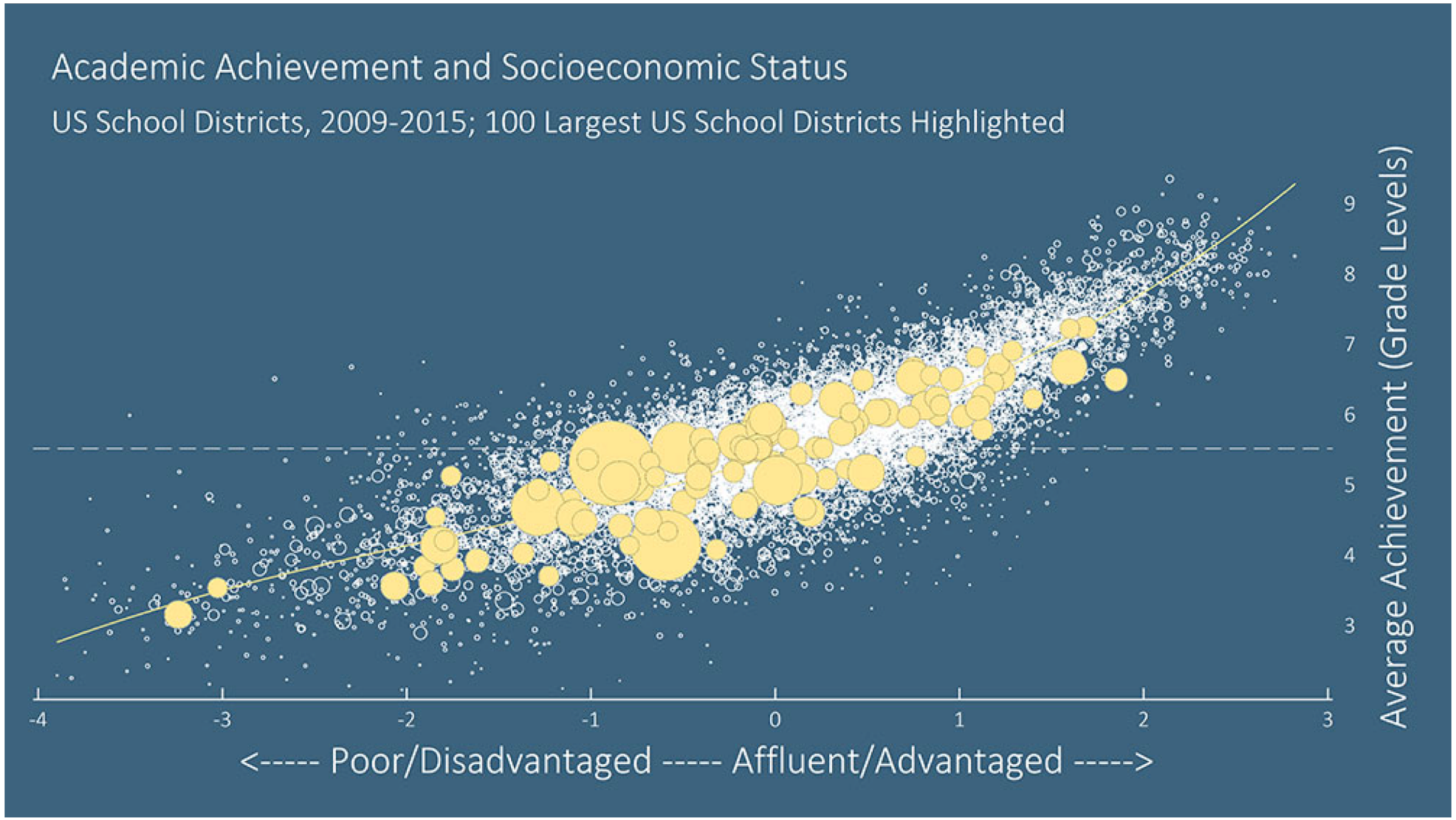
Unit 0

Welcome

Data, Data, Data, Data, Data, ...

Tesla Autopilot

Data, Data, Data, Data, Data, ...



Data, Data, Data, Data, Data, ...

Health Care Policy and Cost

Data are/is Cool

“In God we trust. All others must bring data.”
W. Edwards Deming

“It is a capital mistake to theorize before one has data.”
Sherlock Holmes, “A Study in Scarlett” (Arthur Conan Doyle).

“You can have data without information, but you cannot have information without data.”
Daniel Keys Moran

Purpose of this course

Develop quantitative skills

Prepare you for:
1. Your thesis
2. Your career

What is expected of you

- Attend and participate in class
- Prepare for class (readings before class)
- Professional correspondence with colleagues
- Use assignments to learn
- Ask questions
- Communicate with me

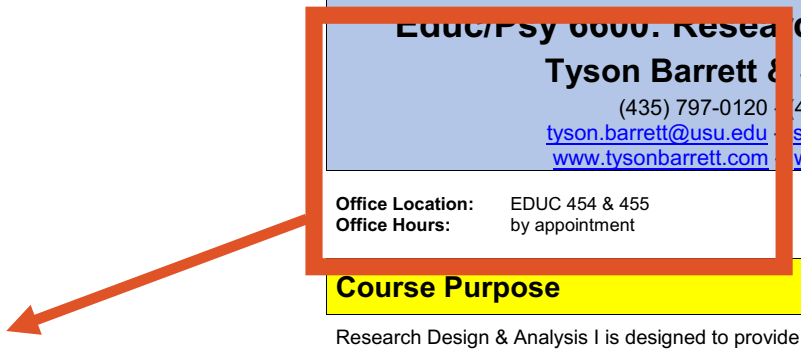
Who am I?

Research Assistant Professor

EDUC 453

tyson.barrett@usu.edu

Office Hours: By appointment



Summer 2018

Educ/Psy 6600: Research Design & Analysis 1

Tyson Barrett & Sarah Schwartz

(435) 797-0120 | (435) 797-0169

tyson.barrett@usu.edu | sarah.schwartz@usu.edu

www.tysonbarrett.com | www.sarahschwartzstats.com

Office Location: EDUC 454 & 455
Office Hours: by appointment

Lecture Location: EDUC 130
Lecture Hours: **M & W 12:00 – 2:45 pm**

Course Purpose

Research Design & Analysis I is designed to provide the student with a **practical, applied approach** to the application of fundamental behavioral and educational research design and statistical principles. Students will learn how to differentiate and appropriately select the best statistical methods for use in various research designs and analytical problems.

This course will mostly focus on **basic statistical techniques** and **several forms of the ANOVA model**, which can be used by themselves or serve as building blocks for more advanced techniques in other courses. Students will also learn how to:

1) use the R statistical programming environment (via the R Studio IDE) to analyze data and

2) interpret and communicate the results of analyses (including creating reproducible research reports with R Markdown).

Prerequisites

- ☐ Completion of EDUC/PSY 6570 'Introduction to Educational & Psychological Research'
- ☐ Passing the EDUC/PSY 6600 pretest (70% or better)

Course Structure

This is a lecture and applied skills course. Students will be expected to demonstrate their learning via *classroom participation, assignments,* and *examinations.* The purpose of class lectures is to elaborate on interesting or difficult material presented in the text, conduct skill-building exercises and demonstrations, and to provide a forum for discussion.

Required Materials

- Cohen, B. H. (2008). **Explaining Psychological Statistics** (4th Ed.). New York: Wiley. *(electronic copy accessible through the USU library for free)*
- ***eBook****: Cohen Companion in R (free online at www.sarahschwartzstats.com)*
- **Canvas** (my.usu.edu) Please check Canvas frequently for course updates, assignments, & grades.
- **R**, **R Studio**, & **TeX** software (all free to download online, instructions will be given)
- **G*Power** software (free for PC or Mac at www.gpower.hhu.de)
- Scientific or statistical **calculator** (may be a graphic calculator, but NOT a cell phone, iPod, ect.)

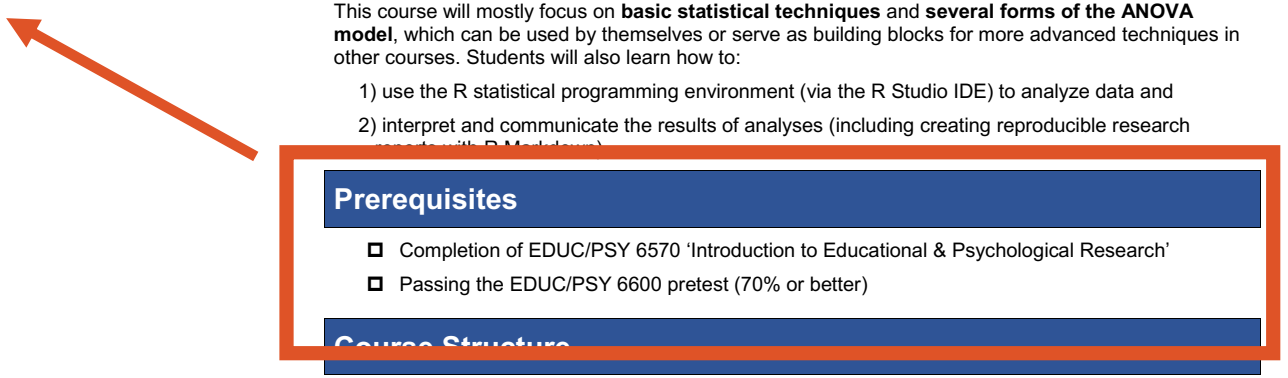
Note: it is advantageous to bring a laptop to class, but not required.

Prerequisites

EDUC/PSY 6570 Pretest

Mandatory

Can take the pretest up until the end of this week



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- Scientific or statistical **calculator** (may be a graphic calculator, but NOT a cell phone, iPod, ect.)

Note: it is advantageous to bring a laptop to class, but not required.

Prep and Attendance

Prepare for class

It makes the lectures much more meaningful and less stressful

We'll talk about the schedule in a moment

Preparation & Attendance

The nature of this course ***requires*** regular class attendance and participation. The student is therefore expected to read assigned chapters **BEFORE** each class session in order to be prepared for classroom activities and discussion (see 'Summaries' below). Please note that this is a 3-credit course in a 7-week period, requiring an average of approximately 18 **HOURS of time outside of class EVERY WEEK** devoted to reading and homework for students who are adequately prepared for this course. Students should **not miss class lectures** as some material covered in class will not be covered in the text. All information covered in the text and lectures is fair game for examination questions. The instructor encourages all students who have or anticipate attendance difficulties to discuss these issues with them as soon as possible.

I. Chapter Summaries — 30% of grade

By design, lectures are designed to enhance your understanding and experience with statistical concepts, rather than present them the FIRST time (**this is not an introductory course**). It is of upmost importance that students read the material **PRIOR** to the designated lecture, as well as read through the associated homework assignment.

This ensures class time may be more valuably spent on answering higher level questions and preparing students for assignments, but more importantly for their conducting their own research. To facilitate this, a chapter **summary or outline** of the assigned readings is due on the day the material is covered in class, **before** the lecture time begins.

Each of the SEVENTEEN chapter's summaries (no summary required for chapter 1) must be no longer than **2 double-spaced pages** using, at a minimum, an **11-point Arial or Times New Roman font with 1-inch margins** throughout. A skeleton will be provided for typing your notes in an **R Notebook using R markdown**. Students may choose to include **tables, formulas, pictures, and examples**. Summaries will be reviewed and assigned credit/no-credit.

Each student must compose his or her own. Summaries must NOT be a copy of the lecture notes. Summaries will be turned in electronically by **4:30 pm** on the due date (see course schedule) via **CANVAS (knitted .pdf format only,** no .Rmd or other formats accepted).

Please also print out each summary on which to record additional study notes in class and use during examinations. Please note, copied summaries (either from posted lecture notes or from students of previous semesters), summaries that violate page specifications, or late summaries will not receive any credit.

II. Unit Homework Assignments — 35% of grade

SEVEN equally weighted unit assignments form the basis for learning the practice of statistics at the level required by this course. The units are outlined on the course schedule (chapters are from Cohen's 4th edition text). Details regarding what is required for each assignment will be available on Canvas & BOX. Assignments require the manipulation or analysis of data and communication of results (complete sentences, too). Most, if not all, assignments will require analysis in R. Additional reading of provided articles may be required, too.

All assignments are REQUIRED: NO scores will be dropped. Students may work together, however each student must turn in his or her own work, **not photocopies or identical replicates**. Assignments are due by **11:59pm** on the due date (see course schedule). Details on what is required to be turned in will be posted on canvas.

Rubrics will be used for grading. Half of the points are earned for **completion** and half for **correctness** (based on a subset of problems chosen for grading). Skipped portions of an assignment may result in loss of points for **BOTH** completeness **AND** correctness. Late assignments turned in within 24 hours of the due date will receive **half** the score earned. No points will be awarded thereafter.

Grading

Grade Components

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III. Examinations — 35% of grade

SIX equally weighted examinations will be given during this course (same unit/chapter breakdown as the assignments; unit 0 does not have an exam). Examinations will be given IN CLASS and will require less than 30 minutes. Examinations will cover all material discussed in class AND in the readings (which are not necessarily one and the same). No code or syntax will be required on exams, however partial output may be included, and students will be expected to interpret the results and communicate the meaning correctly.

All formulas needed will be provided on examinations (unless noted during examination reviews). Applicable statistical tables will also be provided (Appendix A of Cohen's textbook). Calculators may be used, but not any electronic device that may transmit/receive, such as cell phones, ipods, tables, ect.

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Please make every effort not to miss examinations as they cannot be rescheduled unless there is documented evidence for the reason of absence (e.g., serious illness, accident, court). In the event of an emergency the student must contact the instructor immediately and BEFORE the examination.

* No exam is truly comprehensive; HOWEVER, all prior material is fair game on every exam. *

The standard grade breakdown used by Utah State University will be followed to assign the student a letter grade. The final percentage will be determined by a weighted average of the student's percentages earned in each of the three areas.

	B+ 87-89%	C+ 77-79%	
A 93-100%	B 83-86%	C 73-76%	D 60-69%
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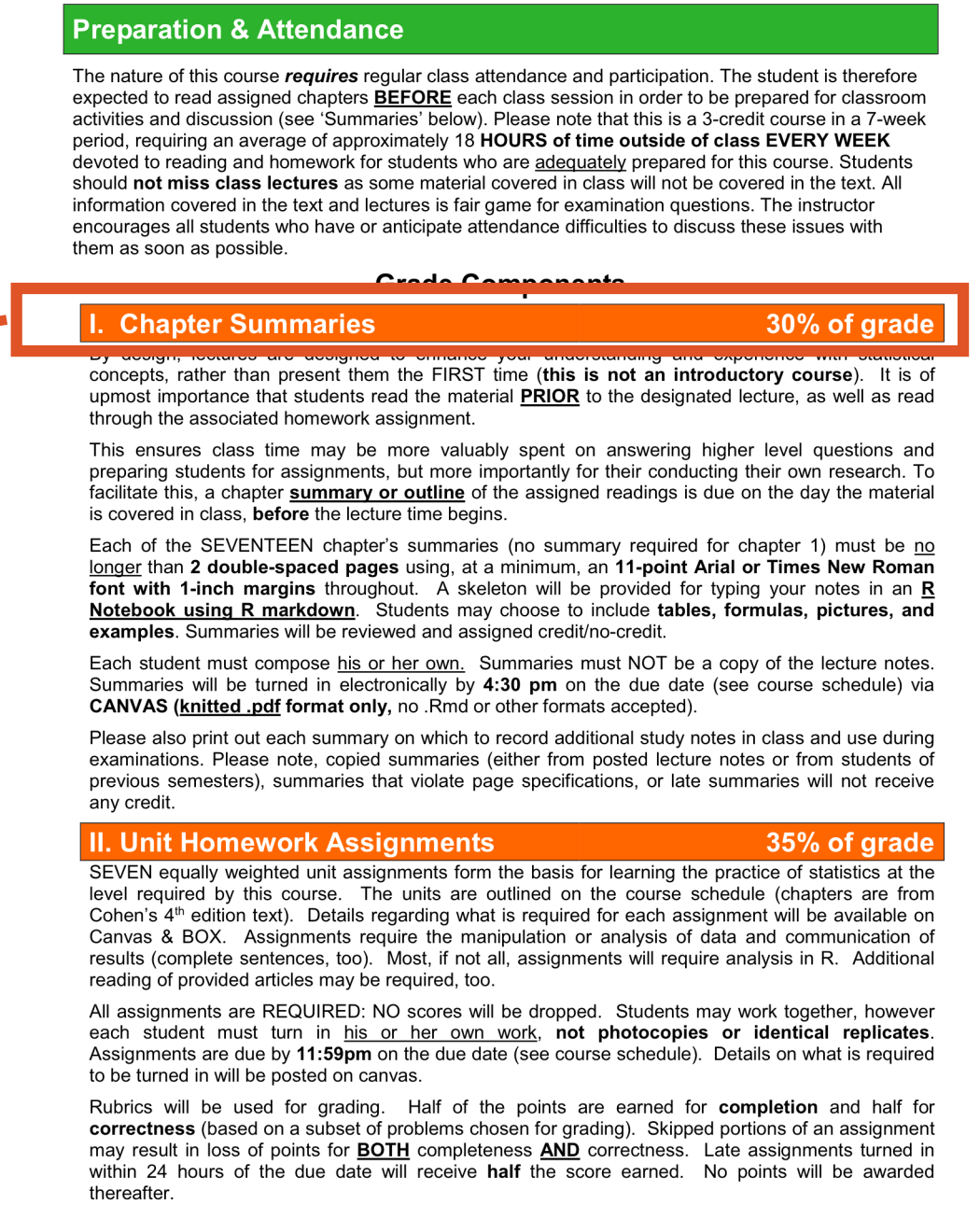
Grading

Summaries

30% of Grade

Essentially free points
-> Can use on Exams

Use RMarkdown (we'll discuss a lot more)



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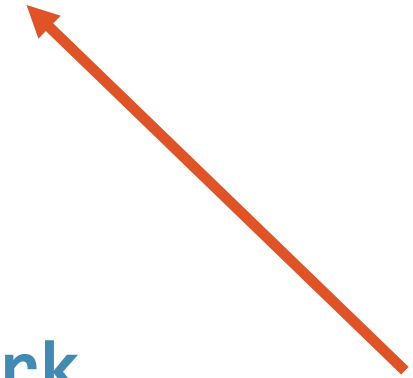
Grading

Assignments

35% of Grade

Can take a lot of work (also can be used on the exams)



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Grading

Exams

35% of Grade

6 Equally weighted
Only 30 min (short)
Open note (use your summaries)

III. Examinations **35% of grade**

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Schedule

- Tentative
- Summaries (and readings) are due before class
- Assignment by the end of the day

Course Schedule

Date	Day	Summary Due 4:30pm	Lecture Topic	Unit	Assignment Due by 11:59pm
May 7	Mon	APA	Syllabus, Textbook, APA Style, & Journal Articles	0	Preparatory Topics
		Ch 1	Variables & Scales, Rounding, Summation		
		R	Ihno's Dataset, R/R Studio Basics, & Data Manipulation		
May 9	Wed	Ch 2	Exploration of Data with Plots	1	HW 0
		Ch 3	Summarizing Data with Descriptive Statistics		Exploratory Analysis
		Ch 4	Standardized Scores & The Normal Distribution		
May 14	Mon		EXAM 1		HW 1
		Ch 5	Intro to Hypothesis Testing: 1 Sample z-test	2	Groundwork for Inference
		Ch 6	Confidence Interval Estimation: The t Distribution		
May 16	Wed	Ch 7	Independent Samples t-Test for Means		
		Ch 8	Statistical Power & Effect Size		
May 21	Mon		EXAM 2		HW 2
		Ch 9	Linear Correlation	3	Hypothesis Tests for 2 Measures Per Subject
		Ch 10	Linear Regression		
May 23	Wed	Ch 11	Matched t-Test		
May 28	Mon	Memorial Day – No Class			
May 30	Wed		EXAM 3		HW 3
		Ch 12	1-way Independent Groups ANOVA	4	ANOVA with Repeated Measures
June 4	Mon	Ch 13	Multiple Comparisons		
June 6	Wed	Ch 14	2-way ANOVA		
June 11	Mon		EXAM 4		HW 4
		Ch 15	Repeated Measures ANOVA	5	ANOVA with Repeated Measures
June 13	Wed	Ch 16	2-way Mixed Design ANOVA		
June 18	Mon		EXAM 5		HW 5
		Ch 19	The Binomial Distribution	6	Categorical Data
June 20	Wed	Ch 20	Chi-Squared Tests		
			EXAM 6		HW 6

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Please read the syllabus in depth

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May 28	Mon		Memorial Day – No Class		
May 30	Wed		EXAM 3		HW 3
		Ch 12	1-way Independent Groups ANOVA	4	ANOVA with Repeated Measures
June 4	Mon	Ch 13	Post Hoc Tests		
June 6	Wed	Ch 14	2-way ANOVA		
June 11	Mon		EXAM 4		HW 4
		Ch 15	Repeated Measures ANOVA	5	ANOVA with Repeated Measures
June 13	Wed	Ch 16	2-way Mixed Design ANOVA		
June 18	Mon		EXAM 5		HW 5
		Ch 19	The Binomial Distribution	6	Categorical Data
June 20	Wed	Ch 20	Chi-Squared Tests		
			EXAM 6		HW 6