Math 338 – Statistics Applied to Natural Sciences, Fall 2019

Fall 2019, Section 09-10 – MW 9:30 – 11:50 AM, MH 491 (Lecture) and 501 (Lab)

Fall 2018, Section 15-16 – TuTh 11:30 AM – 1:50 PM, MH 565 (Lecture) and 452 (Lab)

Course Information

Instructor: Dwight Wynne, Ph.D.

Office: MH 182N **E-mail:** dwwynne@fullerton.edu **Phone:** 657-278-2699

Office Hours: M 2:30-3:30 PM; TuTh 10:00-11:00 AM; or after lab for brief questions; or by appointment

Required Text: *Introduction to the Practice of Statistics, Ninth Edition*. Authors: Moore, McCabe, and Craig. Publisher: MacMillan Learning, 2017. You have two options for purchasing the textbook.

The custom CSUF edition (ISBN 978-1-319-22606-0) includes a loose-leaf paper version of the textbook, and 6 months access to the Sapling homework system including an eBook version of the textbook (total cost: $129.00). If you just want the eBook with the homework system access, that is also available from the CSUF bookstore (ISBN 978-1-319-19579-3; total cost: $78.95).

You can also buy the standard version on your own (ISBN 978-1-319-01338-7, or 978-1-319-01362-2) and buy 6 months access to the Sapling homework system directly from the publisher (total cost: $42.00 + cost of the textbook)

You can also rent the eBook through Sapling for 6 months (total cost: $103.99 including access to the homework system).

Course Objectives

The overall goal of this course is to provide you with a "toolbox" of basic inferential techniques used in science and the ability to choose and use the appropriate tool. My goal is that for each technique, you understand:

1) The situations in which it can be used, with emphasis on using numerical and graphical summaries to help inform the decision
2) Its theoretical and mathematical basis
3) How to generate and understand results using a statistical software, and use those results to make conclusions
4) The limitations of any conclusions drawn from the technique, with emphasis on constraints due to the way in which the data were collected/produced

General Education Learning Goals: This course fulfills a general education requirement under subarea B.5, "Implications and Explorations in the Natural Sciences." The learning goals for this category are to:

a. Integrate themes in mathematics and/or science from cross-disciplinary perspectives.

b. Solve complex problems that require mathematical and/or scientific reasoning.

c. Relate mathematics and/or science to significant social problems or to other related disciplines.

d. When deemed appropriate, apply disciplinary concepts from mathematics and the natural sciences in a variety of settings, such as community-based learning sites and activities.

General Education Writing Requirement: Writing skills are vital in the field of statistics for collecting, evaluating, presenting, and interpreting data, as well as communicating methods and results of statistical inference. Your writing competence will be assessed using assignments and exams incorporating the above skills.

Course Requirements and Grading Policy

Online Homework: Online homework will be assigned through the Sapling platform. See the instructions on the course Titanium page. There are 16 homework assignments so, on average, one assignment will be due per week (some weeks have two assignments due and some have none). Homework must be submitted by 11:00 PM on the indicated Friday. **If you have a problem with Friday due dates, or a problem accessing the homework system, you must talk to me in class/lab/office hours before September 13. Extensions will not be granted for any reason after this date.** Homework will account for 10% of the final grade.

Lab Assignments: The lab section provides time and space for you to complete in-class assignments, typically involving the use of statistical software. You are encouraged to work in groups but must submit individual assignments. I will answer questions about the assignments during the lab section and office hours only. Lab assignments will count for 20% of the final grade.

With occasional exceptions, I will post my solutions to in-class assignments no later than 30 minutes after the lab section. Your solutions must be submitted to Titanium before my solutions are in order to be considered on time. If there are technical or other problems preventing you from uploading your solutions to Titanium, e-mail me with your solutions as an attachment.

No late lab assignments will be accepted. If you know in advance that you will be missing a lab section, you may request a copy of the assignment by e-mail, to be submitted by the end of

the corresponding class period. If a sudden emergency comes up and you are unable to make it to class, you will not receive credit for the assignment and cannot make up the credit; however, **the lowest four (4) lab assignment grades will be dropped.**

Exams: Two (2) midterm exams and a final exam will be given. **All exams are cumulative and will involve both lecture and lab components.** I will let you what reference materials will be allowed and/or provided at least one week prior to each exam. Each midterm exam will count for 20% of the final grade. The final exam will count for 30% of the final grade.

If you score better on the lecture component of the final exam than at least one midterm lecture exam, your final lecture exam score will replace the lower midterm lecture exam score (including a missed exam). The same will apply for the lab component.

Makeup Exams: Missed midterm exams cannot be made up. The final exam can only be made up in extreme circumstances and with advance permission of the instructor. If you feel that a sudden illness is sufficiently extreme to warrant a makeup final exam, you must present the instructor with documentation prepared by an appropriate authority.

Exam Dates:

Midterm 1: Wednesday, October 10/Thursday, October 11

Midterm 2: Tuesday, November 20/Wednesday, November 21

Final Exam:

Section 09-10: Monday, December 16, 9:00-11:50 AM in MH 491/501*

Section 15-16: Thursday, December 20, 11:00 AM-12:50 PM in MH 565/501*

*Subject to availability of the computer lab and whether the lab exam is in-class or take-home

Extra Credit: Some assignments and exams may have "extra credit" in that it is possible to score over 100% on the assignment/exam. Additional assignments for extra credit will not be given under any circumstances.

Grading Breakdown:

Homework	Labs	Midterm Exam 1	Midterm Exam 2	Final Exam
10%	20%	20%	20%	30%

I take a weighted average of your percent score in each of the categories as shown in the table above, and assign letter grades based on the final weighted percentage, according to the table below. **I reserve the right to decrease the thresholds for one or more letter grades.** I will not increase the thresholds; for example, if everyone gets 92% everyone gets an A.

Grade	A+	A	A-	B+	B	B-	C+	C	D+	D
Percentage	95%	92%	89%	86%	83%	80%	76%	70%	66%	60%

Students who fail to earn a course percentage of at least 60% will receive a failing (F) grade.

A grade of "C" (2.0) or better is required to meet this General Education requirement. A grade of "D+" (1.3) or below will not satisfy this General Education requirement.

Course Outline

We will have three modules in this course. Midterm 1 will be on Module 1 material; Midterm 2 will focus on Module 2 material but will require knowledge from Module 1.

Module 1 (Weeks 1-7): Probability, summaries, and statistical inference for categorical variables

Module 2 (Weeks 8-13): Probability, summaries, and statistical inference for numerical variables

Module 3 (Weeks 13-16): Summaries and statistical inference for relationships between numerical variables

A tentative schedule for the Monday/Wednesday section is below. The Tuesday/Thursday section will cover the same topics in the same order.

Week	Day	Date	Topics	Pages Covered
1	Monday	26-Aug	Introduction to Probability	215-232
	Wednesday	28-Aug	Simulation, Discrete Random Variables, and Probability Mass Functions	235-239
2	Monday	2-Sep	LABOR DAY – NO CLASS	
	Wednesday	4-Sep	Expected Value and Variance of a Discrete Random Variable	246-261
3	Monday	9-Sep	Samples, Variables, and Summary Statistics	1-7, 282-291
	Wednesday	11-Sep	Designing Experiments	171-185, 203-211
4	Monday	16-Sep	The Binomial Setting and Binomial Distribution	311-321
	Wednesday	18-Sep	Two-Way Tables, Conditional Probabilities, and Bayes' Rule	136-143, 267-274
5	Monday	23-Sep	Introduction to Hypothesis Testing: H_0/H_a, Test Statistics, and Decision Rules	361-365
	Wednesday	25-Sep	Introduction to Hypothesis Testing: Errors and Power	396-400
6	Monday	30-Sep	Introduction to Hypothesis Testing: p-values and Problems	365-370, 384-389

	Wednesday	2-Oct	Extending to Multiple Proportions: Goodness-of-Fit Test	545-550
7	Monday	7-Oct	Extending to Multiple Populations: Test of Independence	526-540
	Wednesday	9-Oct	MIDTERM EXAM 1	
8	Monday	14-Oct	Continuous Random Variables, Density Curves, and Normal Distribution	51-57, 61-62, 239-243
	Wednesday	16-Oct	Error and Variability with Numerical Variables	11-21, 27-43
9	Monday	21-Oct	Sampling Distribution of the Sample Mean: Central Limit Theorem	293-305
	Wednesday	23-Oct	Standard Error of the Mean and t-Statistics	408-410
10	Monday	28-Oct	t-Test for a Population Mean	412-415
	Wednesday	30-Oct	Extending to Two Populations: t-Test for Population Mean of Paired Differences	419-421
11	Monday	4-Nov	Extending to Two Populations: t-Test for Difference of Population Means	439-442
	Wednesday	6-Nov	Extending to More than Two Populations: One-Way ANOVA	644-650, 656-663
12	Monday	11-Nov	VETERANS DAY – NO CLASS	
	Wednesday	13-Nov	Confidence Intervals for Means and Proportions	343-347, 410-412, 436-439, 484-489
13	Monday	18-Nov	Relationship between Confidence Intervals and Hypothesis Tests	375-377
	Wednesday	20-Nov	MIDTERM EXAM 2	
14	Monday	25-Nov	Scatterplots, Correlation, and Basics of Linear Regression	79-118
	Wednesday	27-Nov	FALL BREAK – NO CLASS	
15	Monday	2-Dec	Hypothesis Tests for Simple Linear Regression	TBA
	Wednesday	4-Dec	Confidence and Prediction Intervals for Simple Linear Regression	TBA
16	Monday	9-Dec	Multiple Linear Regression	TBA
	Wednesday	11-Dec	Identifying the Appropriate Inferential Procedure	TBA
Finals			Final Exam	

Required Technology

Calculator: A scientific or graphing calculator is required for the lecture component of exams. It is recommended that students bring the calculator to lecture as well, since cell phones should not be used as calculators during class. For lab activities and exams, students may use the lab computer or their personal laptop/tablet computer.

Software: Use of statistical software will be crucial for completion of lab/homework assignments and lab exams. You will typically have a choice of statistical software between R and Rguroo.

R (http://www.r-project.org) is a combination software environment and programming language specialized for statistics and data analysis. R is available in the computer lab and is also freely available for download to Windows, Mac, and Unix systems. R Studio is a popular and open-source integrated development environment for R and is also available in the computer lab; to download R Studio to your own device, please visit http://www.rstudio.com.

Rguroo (http://rguroo.com/) is a browser-based point-and-click interface for R that eliminates much of the need for writing scripts. 12-month access to Rguroo is free to CSUF students using their official CSUF student e-mail account. As part of the first lab session, students will sign up for a temporary Rguroo account. Late enrollees will sign up for a temporary Rguroo account at their first lab session. Rguroo can work but is not optimized for mobile devices. Rguroo works best with the Chrome browser.

In general, students who are interested in learning new programming languages, or students who plan to take additional courses in statistics, should use this course to become familiar with R and R Studio. Most other students should use Rguroo. Students are welcome to use the first few weeks to become familiar with both programs and decide which one they prefer.

Additional Class Policies

Classroom Etiquette Policy:

While you are in Math 338, I expect you to:

1. Have your cell phone on silent and put away unless I tell you to take it out.
2. Use computers/tablets only for appropriate class-related activities.
3. Follow posted policies regarding food and drink in the classroom.
4. Make a good faith attempt to engage with the material.

If you do not meet these expectations, you will be asked to log off, put a device away, and/or leave the classroom. Students who refuse to comply will receive a zero on the activity/exam and may be subject to further disciplinary action.

Departmental Electronic Device Policy: The Mathematics Department has instituted a zero-tolerance policy prohibiting the use of electronic devices such as cell phones, tablets, smart watches, etc. during assessments (including, but not limited to, quizzes and exams). For assessments involving use of a computer, this policy also prohibits use of any computer application, website, or document not explicitly permitted by the instructor.

Students found to be in violation this policy will be subject to disciplinary action, including receiving a grade of zero on the assessment; receiving a failing grade in the course; and/or being reported to the Dean of Students Office.

Academic Dishonesty: Examples of actions that constitute academic dishonesty include, but are not limited to:

1. Unacceptable examination behavior – communicating with fellow students, copying material from another student's exam, possessing or using unauthorized materials **including electronic devices not explicitly allowed**, or any behavior that defeats the intent of an exam, or allowing another student to partake in unacceptable examination behavior.

2. Plagiarism – taking the work of another and offering it as one's own without giving credit to that source, whether that material is paraphrased or copied in verbatim or near-verbatim form.

3. Unauthorized collaboration on a project, homework or other assignment.

4. Documentary falsification including forgery, altering of campus documents or records, tampering with grading procedures, fabricating lab assignments, or altering medical excuses.

I expect that you will familiarize yourself with the academic integrity guidelines found in the current student handbook (see http://hhd.fullerton.edu/MSW/documents/StudentHandbook.pdf).

Students who fail to uphold the university's standards of academic integrity will be subject to disciplinary action, including, but not limited to, receiving a grade of zero on the assessment; receiving a failing grade in the course; and/or being reported to the Dean of Students Office.

Additional Course Information

Special Needs: Students with disability or special needs that may require specific arrangements or accommodations relating to attending class sessions, completing course assignments, and/or taking exams should contact the instructor during the first week of classes, or the first week after such accommodations become necessary. Students with disabilities need to document the disability at the Office of Disability Support Services (UH 101, 657-278-3112).

Emergency Policies: In the event of an emergency (such as an earthquake or fire):

- Take all your personal belongings and leave the classroom. Use the stairways located at the east, west, or center of the building.
- Do not use the elevator. They may not be working once the alarm sounds.
- Go to the lawn area towards Nutwood Avenue. Stay with class members for further instruction.
- For additional information on exits, fire alarms and telephones, **Building Evacuation Maps** are located near each elevator.
- Please see the instructor if you have (or anticipate having) difficulty evacuating the building.

How to Add or Drop This Class

Adding is done through Titan Online. You may be required to obtain a permit from the Mathematics Department in McCarthy Hall 154 in order to be able to enroll. Adding via Titan Online must be completed by **September 10**.

The procedure for dropping this class depends on the date.

Before September 10: Drop through Titan Online. You will not receive a grade of "W".

After September 10, Before October 4: Obtain a Request for Withdrawal form, complete it, and explain to me why you intend to drop the class. If I agree to allow you drop the class, I will sign the form, and you must bring the form to the Mathematics Department in McCarthy Hall 154 to obtain additional signatures. Once you have acquired all necessary signatures, the form should be submitted to Registration and Records, Langsdorf Hall 114. **Neither my approval nor the approval of the Mathematics Department is guaranteed.**

You will receive a grade of "W."

After October 4, Before November 14: Obtain a Request for Withdrawal form, complete it, and provide supporting documentation showing a serious and compelling reason beyond your control. If I agree to allow you drop the class, I will sign the form, and you must bring the form to the Mathematics Department in McCarthy Hall 154 to obtain additional signatures. Once you have acquired all necessary signatures, the form should be submitted to Registration and Records, Langsdorf Hall 114. **Neither my approval nor the approval of the Mathematics Department is guaranteed.**

You will receive a grade of "W."

After November 14: Dropping through official channels is impossible.

Students who stop attending class without having officially dropped will receive a grade of F. This grade does not satisfy the General Education requirement. It is your responsibility to verify that you have officially dropped the course.