MATH 211 Statistical Concepts and Methods
SPRING 2022 (Mar 29 – Jun 3)

Instructor: Sahadeb Upretee, PhD   Office Hours: MTWR 1:00 - 2:00 pm or by appointment
E-mail: upretees@cwu.edu   Classroom: Samuelson 113 (MTWF)
Class Time: MTWRF (11:00 AM - 11:50 AM)   Lab: Samuelson 138 (R)

Hello! You are welcome to the MATH 211 Statistical Concepts and Methods

TEXTBOOK: Diez, et. al. OpenIntro Statistics, 4th edition.
The book can be downloaded for free at https://www.openintro.org/book/os/ , or ordered very inexpensively on Amazon.

PRE-REQUISITES: Satisfactory score on placement exam or completion of MATH 100B or permission of the instructor

COURSE CONTENT: An introduction to statistics for any student. Topics include exploratory data analysis, regression, sampling distributions, hypothesis testing, and confidence intervals. The course emphasizes applied data analysis and includes the use of a statistical software package

Learner Outcomes:

Upon successful completion of this course, the student will be able to:
- Apply tools of exploratory data analysis (both graphical and numerical summaries) to describe the distribution of variables and the relationships between them.
- Describe the relationships between variables using graphs (scatterplots or bar graphs), tables (two-way tables, marginal and conditional distributions), and equations (regression lines), as appropriate.
- Identify types of study design and sampling and determine whether these designs are being used appropriately.
- Calculate test statistics, p-values, and confidence intervals.
- Use statistical tools, including hypothesis tests and confidence intervals, to draw conclusions and make judgments based on real data sets.
- Choose the appropriate statistical tool for a given situation.
- Evaluate whether assumptions for a given statistical model are met.
- Write statistical problems and results clearly and correctly.

Unit 1: Introduction to data
 Case study: using stents to prevent strokes, data basics, sampling principles and strategies, experiments

Learning Outcomes
The students will be able to:
- identify variables as numerical and categorical
- distinguish between simple random, stratified, cluster, and multistage sampling, and recognize the benefits and drawbacks of choosing one sampling scheme over another

Unit 2: Summarizing data
Examining numerical data, considering categorical data, case study: malaria vaccine

Learning Outcomes
The students will be able to:
- use frequency tables and bar plots to describe the distribution of one categorical variable
- identify the shape of a distribution as symmetric, right skewed, or left skewed
- use histograms and box plots to visualize the shape, center, and spread of numerical distributions
- describe commonly used measures of center (mean, median, mode) and spread (standard deviation, range, interquartile range)

Unit 3: Probability
Defining probability, conditional probability, sampling from a small population, random variables, continuous distributions

Learning Outcomes
The students will be able to:
- distinguish marginal and conditional probabilities
- construct tree diagrams to calculate conditional probabilities and probabilities of intersection of non-independent events using Bayes' theorem
- calculate the probability of union of events using the (general) addition rule

Unit 4: Distributions of random variables
Normal distribution, geometric distribution, binomial distribution, negative binomial distribution, Poisson distribution

Learning Outcomes
The students will be able to:
- define the standardized (Z) score of a data point
- calculate probabilities, mean, variance of normal distribution, geometric distribution, binomial distribution, negative binomial distribution, Poisson distribution

Unit 5: Foundations for inference
Point estimates and sampling variability, confidence intervals for a proportion, hypothesis testing for a proportion

Learning Outcomes
The students will be able to:
- construction the null hypotheses & alternative hypothesis
- calculate a p-value as the area under the normal curve beyond the observed sample proportion
- compare the p-value to the significance level to make a decision between the hypotheses
- construct confidence interval for a population parameter

Unit 6: Inference for categorical data
Inference for a single proportion, difference of two proportions, testing for goodness of fit using chi-square, testing for independence in two-way tables

Learning Outcomes
The students will be able to:
- calculate the sampling variability of the proportion, the standard error
- calculate the standard error of the distribution of the difference in two independent sample proportions
- use a chi-square test of goodness of fit to evaluate if the distribution of levels of a single categorical variable follows a hypothesized distribution

Unit 7: Inference for numerical data
One-sample means with the t-distribution, paired data, difference of two means, power calculations for a difference of means, comparing many means with ANOVA

Learning Outcomes
The students will be able to:
- use the t-distribution for inference on a single mean, difference of paired (dependent) means, and difference of independent means
- describe how to obtain a p-value for a t-test and a critical t-score for a confidence interval
- explain how power changes for changes in effect size, sample size, significance level, and standard error
- describe why it is possible to reject the null hypothesis in ANOVA but not find significant differences between groups as a result of pairwise comparisons

Unit 8: Introduction to linear & multiple regression

Fitting a line, residuals, correlation, least squares regression, types of outliers in linear regression, inference for linear regression, introduction to regression, introduction to logistic regression

Learning Outcomes
The students will be able to:
- define the explanatory variable as the independent variable (predictor), and the response variable as the dependent variable (predicted)
- define R^2 as the percentage of the variability in the response variable explained by the explanatory variable
- fit and interpret liner regression, multiple regression, and logistic regression

IMPORTANT DATES:
Tuesday, Mar 29 – First day of classes.
Class End: June 4
Study day: June 6
Memorial Day: May 30 – No class
Midterm Exam One: May 2
Midterm Exam Two: May 27
Comprehensive Final Exam: Update later

EVALUATIONS:

Attendance and Participant:	5%
Weekly Assignments:	20%
Weekly Lab	10%
Project(s)	5%
Midterm Exam One:	15%
Midterm Exam Two:	20%
Comprehensive Final Exam:	25%

GRADING SCALE (MINIMUM CUTOFFS):

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
93	90	87	83	80	77	73	70	67	63	60	below 60

CALCULATOR: You may use any scientific calculator

CELL PHONE POLICY
I will not allow cell phones or similar devices to be used during exams. This includes using your phone as a calculator.

TIME INVESTMENT REQUIREMENT:
The information listed below illustrates the total investment of time by an average student to achieve the learning goals of the course. (30 hours/credit x 5 = 150 hours)
The amount of time that an average student should expect to spend on this class is as follows:
- 50 hours - Time spent in the classroom, online instruction, taking exams and doing worksheets etc.
- 100 hours - Time for preparation and study for worksheets, assignment, monthly and final exams, discussion during the office hours.

EMAIL CORRESPONDENCE: I will respond to student communications during business hours (M-F, 8am-5pm). You can typically expect a reply within approximately 24 hours, not including weekends. If you email me with questions about specific problems, I can be more helpful if you send pictures of what you've tried so far.

HOMEWORK: Each week homework will be assigned, and due dates will be announced in the Canvas. Students are encouraged to discuss among the friends but do not copy other's work directly. If I find identical solutions, then both parties will get zero points. Your work should be clear, in a logical order, and provide sufficient explanation. You must upload a single pdf file of the homework into Canvas.

EXAM POLICY: There will be two midterm exams and one comprehensive final exam. All exams are cumulative. Each exam will have two parts, written and lab. The written exam will be taken in class, will be timed, and you will be allowed to use your book and notes. But the lab part will be in take-home format.

LAB ASSIGNMENTS: Each Thursday (except exam weeks) we'll be doing a lab assignment using statistical software R. You need to complete the weekly lab assignment via Canvas by Sunday 11:59 PM. The lab work must be typed, written in complete sentences, organized in logical ways.

PROJECTS: There will be one or two smaller projects during the quarter. You can complete the project in a group or individual.

COURSE POLICIES

COVID-19 STATEMENT:

- As of March 19, 2022, masks will be optional in non-instructional indoor spaces on campus (e.g. hallways, foyers, and other common areas).

- After April 8, 2022, masks will be optional in indoor instructional spaces on campus, with the following exceptions for certain instructional settings:
  a. Any classes (e.g. laboratories or similar) which require close contact. Faculty instructors for such classes will state in their syllabus that masks will be required.
  b. CWU-owned or contracted vans or buses transporting students on field trips or other instruction-related travel. Faculty instructors will state in their syllabus that masks will be required during such travel.

MENTAL HEALTH STATEMENT:

"Stress and other life circumstances that may be out of your control can make learning and focusing difficult. If you find stress or other mental health concerns make academics difficult, Central has resources to support you. I encourage you to reach out as soon as you notice you're struggling."

RESOURCES FOR STUDENTS:

CWU Counseling Center: https://www.cwu.edu/medical-counseling/counseling-clinic

Mental Health Crisis Support outside normal business hours: 1-800 – 273 - 8255, Text HOME to 741741 or call 911.

Wellness Center: https://www.cwu.edu/wellness/   509-963 -3213

Student Rights and Responsibilities: https://www.cwu.edu/student-rights/office-student-rights-responsibilities

POLICY ON ACADEMIC DISHONESTY:
Students are on their honor to follow the student conduct code as outlined in the Washington Administrative Code. Violations of this section will result in a failing grade in the course in addition to further possible university sanctions. (See http://apps.leg.wa.gov/WAC/default.aspx?cite=106-125)

POLICY ON DIVERSITY:
University-level education is about broadening horizons and looking at academic issues from a variety of perspectives. With this in mind, the participants in this class are encouraged to bring their own life experiences and viewpoints to bear on classroom discussions and assignments. Along with the freedom to express one's own views comes the responsibility to respect the views of others. No student will be discriminated against on the basis of race, ethnicity, age, creed, religion, gender, sexual orientation, marital status, or political ideology.

DISABILITY SERVICES:
Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any obstacles to learning, contact Disability Services to discuss a range of available options. Student Disability Services is located in Hogue 126. Call (509) 963-2214 or email ds@cwu.edu for more information. (see https://www.cwu.edu/disability-services/)

SUBMITTING ELECTRONIC FILES:
All electronic files must be submitted in .doc, .docx or .pdf format. If you don't have Microsoft Office, you can download it for free, using your CWU email and password from the MS Office website. Here is the guide on (https://cwu.teamdynamix.com/TDClient/2015/Portal/KB/ArticleDet?ID=9080), how to download MS Office. Mac users make sure to save documents with visible extension (.docx or .rtf).

RELIGIOUS HOLIDAY ABSENCES: In compliance with RCW 28B.137.010, CWU makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor within the first two weeks of class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.