STAT 2050: Introduction to Statistical Methods
Semester: Fall 2023
Class Time: MTWR 11:00 am- 11:50 am
Room: LA 006

Instructor: Mohammad Islam
Office: LA 121r
Email: mislam@uvu.edu
Phone: 801-863-6430

Office Hours: MTWR from 12:00 pm-1:00 pm and by appointment

Textbook: **Statistics Unlocking the Power of Data, by Robin H. Lock, Patti Frazer Lock, Kari Lock Morgan, Eric F. Lock, Dennis F. Lock, 3rd edition**

Note: You don't need to buy the textbook. Students who registered for STAT 2050 have an inclusive access to the eBook through Wiley Course Resources on canvas course STAT 2050.
The eBook can be accessed through canvas. Clicking Wiley Course Resources on canvas will take you to the eBook.

Prerequisite:
MATH 1050 with a grade of C or better within the last 2 years or an appropriate placement (taken within the last two years).

Statistical Software:
R will be the primary statistical software used in this course. R is freely available at https://www.r-project.org/. The use of R is required for your Homework/ projects and exams. I recommend the use of RStudio IDE, available for free at https://rstudio.com/. If you do not already have R and RStudio, you may download them from the websites above. If you are unfamiliar with the language, there are lots of resources available online. Never underestimate the power of googling things and finding R code!

Final Exam:
Wednesday, Dec 13, 2023, from 11 am to 12:50 am. Failure to take the final exam will result in a grade of UW or E (based on the last date of attendance) for the course regardless of other grades. It is school policy that no one will be permitted to take a final exam early.

Course Description:
The main objectives of STAT 2050 are to give the student an introduction to the practice of statistics. This course will give insight into how to gather, summarize, and draw conclusions from data. Chapters 1-7, 9 -10, and P from the textbook will be covered. Specifically, the following topics will be covered:

- **Data Collection (Ch. 1)**
  - Simple Random Sampling
  - Observational Experiments vs Designed Experiments
  - Design of Experiments
    - Completely Randomized Design
    - Match-Pairs Design

        - Randomized Block Design
- **Graphs and Summary Statistics (Ch. 2)**
    - Organizing and displaying qualitative data with Bar chart, Pie chart, and creating contingency table for two or more categorical variables
    - Organizing and visualizing quantitative data with Stem-plot, Dot plot, Frequency distribution, Histogram
    - Measures of central tendency – Mean, Median, Mode
    - Measures of Dispersions- Range, Variance, Standard Deviation, Interquartile range (IQR)
    - Finding outliers and measures of positions – Percentile, Quartile, Boxplot for five-number summary

- **Normal Distribution (Ch. 5)**
    - The rules of Normal Distribution in statistical inference and its applications
    - Assessing normality

- **Sampling Distribution (Ch. 5)**
    - Concept of sampling distribution and Central Limit theorem (CLT)
    - Distribution of the sample mean– t-distribution
    - Distribution of sample proportion – normal distribution
    - Distribution of the ratio of two independent sample variances– F-distribution
    - Use of the sampling distribution to find the p-value for a test statistic
- **Confidence interval (Ch. 3)**
    - Understanding and interpreting confidence interval
    - Constructing confidence interval for a population mean, a population proportion, and a difference in two population means and proportions
    - Bootstrap confidence intervals
- **Hypothesis Testing (Ch. 4,5, 6, 7)**
    - Measuring evidence with p-values
    - Determining statistical significance
    - Hypothesis Tests for a population mean, and a population proportion, the equality of two population proportion, the equality of two population means when samples are independent, the equality of two population means when samples are dependent
    - Hypothesis testing for categorical data
        - Goodness of fit with chi-square test
        - Tests for independence and the homogeneity of proportions with chi-square test

- **Correlation and Regression (Ch 2, 9, 10)**
    - Concept of correlation and causation and finding the correlation and testing the significance of the correlation
    - Least -Squares Regression for single, and multiple explanatory variables
    - Testing the significance of the least -square regression model
    - Logistic regression analysis and its applications (Brief discussion, materials will be provided because the text does not have this topic)

Learning Outcomes:
At the end of the course, the student will have a good understanding of some statistical methods used in biological research. They will also be able to identify the appropriate statistical methods for analyzing data in their fields, be able to analyze them using R, and be able to interpret the results. More specifically, they will be able to

- Demonstrate understanding of the difference between controlled experiments and observational experiments.
- Summarize data numerically and graphically.
- use the sampling distributions of statistic to find the p-value for a test statistic
- Compute confidence intervals for different parameters of interest
- Conduct significance tests for one, two, and more than two sample cases
- Use statistical methods - linear regression, chi-square tests, and ANOVAs
- Apply some basic probability rules such as Bayes' theorem to real life data
- How to use some discrete and continuous distributions to real life data

Course evaluation:

Projects:	25%
Learning Checks:	30%
Tests:	45%

HW/Project:

The HWs/ Projects on the selected chapters or topics along with datasets will be given. To complete the projects, students will need to use statistical software R. Some projects require analyzing the real datasets and write a report.

Learning Check:

At the end of each unit, a Learning Check will be assigned. These checks will include the material covered that week. The LC will be completed using the online homework system that comes with the textbook. These LC can be accessed through canvas.

Class Participation:

Attendance at all class sessions is required. You are expected to come to each class session on time, actively participate in each class, and conduct yourself in a manner consistent with professional standards. You should be actively involved in class activities, make thoughtful contributions to class discussions, and do all this in a way that shows respect for others and their ideas.

Attendance is a critical component of your education, as sometimes we will discuss topics in class that are not in the book. You are responsible for all information presented in class, whether you are present or not. If you know you will need to miss a class, you should let me know ahead of time. You should also assume responsibility for finding out what you missed and make arrangement to make up any assignments you can make up.

Tests:
There will be four tests, including the Final Exam. The final will be mainly on the materials used in the final project. Students must come to the class to take the test. Problems on the tests will be similar to examples done in class and to problems in your projects. A student must provide the written documentation supporting the need for a make-up test.

Exam	Tentative Date
1. (Ch 1, 2, 3- Sampling Distribution, 5-Normal Distribution, p.5)	Sept 18
2. (Ch 3-Confidence interval, 4, 6.1-6.2)	Oct 18
3. (Ch 6.3-6.5, 7)	Nov 16
4. (Final Exam on 9, 10, and Ch P.2-p.4)	Dec 13 Wednesday, 11:00 pm-11:50 pm

Academic Integrity:
You are expected to complete course assignments, projects/ learning checks in a manner that is consistent with the ethical standards of Utah Valley University. You are expected to conform to UVU's academic integrity policy and do your own work on assignments unless they are designed as collaborative efforts. Whether completed individually or collaboratively, all course assignments and assessments should be generated from your own learning. Your work should not be copied from other students, internet sites, or published materials. If you draw heavily from a particular source of information, that source should be credited and cited in your assignment.
If it is discovered that you have been involved in any form of academic misconduct in the completion of an assignment for this course, you will receive a grade of "0" for that work, and your final grade for the course will be significantly affected. If it is discovered that you have been involved in the act of academic misconduct on more than one occasion, you will be dropped from the class.

Grading Scale:

A	92%-100%
A-	90%-92%
B+	86%-90%
B	82%-86%
B-	80%-82%
C+	76%-80%
C	72%-76%
C-	70%-72%
D+	66%-70%
D	62%-66%
D-	60%-62%
F	0%- 60

Important Dates:

Sept 13 –Last Day to Drop and Not Show on Transcript
Sept 15– Last Day to Add Classes
Oct 31 – Last Day to Withdraw
Fall Break- Oct 19-21 and Thanksgiving break-Nov 20-25
Dec 13– Final Exam

Math Lab Information:
The Math lab provides resources for students taking UVU math courses. Services include both in-person and on-line tutoring, and video lectures.
For location and hours visit: http://www.uvu.edu/mathlab/tutoringservices/index.html.

Students with Disabilities:
If you have any disability that may impair your ability to complete this course successfully, please contact the Accessibility Services Department (801-863-8747, AccessibilityServices@uvu.edu, LC 312. Academic accommodations are granted for all students who have qualified, documented disabilities. Services are coordinated with the student and instructor by Accessibility Services.

General Comments:
Attending online class regularly is important for you to succeed the class. If you miss class, you are responsible for understanding the material covered during the class.
Please make sure you understand the material as it is presented. Note that if you fall behind, it will be nearly impossible to catch up Your understanding of the material to be covered will help the class move smoothly.

Note: All items in this syllabus are subject to change or modification to correct errors or to accommodate extenuating circumstances.

Tentative Weekly Scheduled

Week	Materials	Chapter
1	▪ Sampling from populations, Observational, and controlled experiments ▪ Design of Experiments ○ Completely Randomized Design ○ Match-Pairs Design ○ Randomized Block Design	Ch. 1
2	▪ Organizing and displaying qualitative data ○ Bar chart, Pie chart, creating contingency table ▪ Organizing and visualizing quantitative data ○ Stem-plot, Dot plot, Frequency distribution, Histogram ▪ Measures of central tendency ○ Mean, Median, Mode	Ch. 2
3	▪ Measures of Dispersions- ○ Range, Variance, Standard deviation, Interquartile range (IQR) ▪ Finding outliers and measures of position – ○ Percentile, Quartile, Boxplot for the five-number summary	Ch.2
4	▪ Normal Distribution ○ The rules of Normal Distribution in statistical inference and its applications ○ Assessing normality	Ch. 5
5	▪ Confidence Intervals ○ Understanding and interpreting confidence interval ○ Constructing confidence interval for a population mean, and a population proportion	Ch. 3
6	▪ Confidence intervals ○ a difference in two population means and proportions ○ Bootstrap confidence intervals	Ch. 3

7	▪ Sampling Distribution o Concept of sampling distribution and Central Limit theorem (CLT) o Distribution of the sample mean – t-distribution o Distribution of sample proportion o The ratio of two independent sample variances- F-distribution o Use of the sampling distribution to construct confidence intervals using bootstrap methods	Ch. 5
8	▪ **Hypothesis Testing** o Measuring evidence with p-values o Determining statistical significance o Hypothesis Tests for a population mean, and a population proportion	**Ch. 4, 5, 6**
9	▪ Hypothesis Testing: o Hypothesis testing for the equality of two population proportion o Hypothesis testing for the equality of two population means when samples are independent o Hypothesis testing for the equality of two population means when samples are dependent	Ch 4, 5, 6
10	▪ Hypothesis testing for categorical data o Goodness of fit-chi-square test o Tests for independence and the homogeneity of proportions (chi-square tests)	Ch.7
12	▪ **Correlation and Regression** o Concept of correlation and causation and finding the correlation and testing the significance of the correlation o Least -Squares Regression for single variables	Ch. 2, 9
13	▪ Multiple Regression o Least -Square regression model for multiple factors o Testing the significance of the least -square regression model	Ch. 10
14	▪ Probability Basics o Bayes Rules o Random Variables and Probability Functions o Binomial Distribution	Ch 11
15	Review the statistical methods and concepts learned	