BIOL/PSYC/SOCI 324 (Hybrid)
Statistics for the Behavioral and Natural Sciences

Early Fall Session 15/11
August 17 – October 10, 2015

Course Description
The study of parametric and nonparametric statistics commonly used in the behavioral and natural sciences. Included are analyses of relationship and variance, as well as effect sizes associated with each.

Prerequisite: Grade of C or higher in MATH 150 or higher-level math course (excluding MATH 200).

Class Day and Time: Wednesday, 6:30 pm – 9:30 pm, Crystal Lake Campus

This is a hybrid course which is defined as an online course supported by a weekly in-seat class. Our class will consist both in-seat and online instruction through various resources, discussion and homework. Please note that we will meet every week, unless otherwise noted.

You are expected to attend every class. If you know prior to the beginning of the session that you will miss more than one in-seat class, it is strongly recommended that you wait to take this course at another time.

The online portion of our course is located in D2L. You will access the course through CougarTrack.

Textbooks
ISBN: 978-1-133-31253-6

Textbooks for the course may be ordered from MBS Direct. You can order
  • online at http://direct.mbsbooks.com/columbia.htm (be sure to select Online Education rather than your home campus before selecting your class)
  • by phone at 800-325-3252

For additional information about the bookstore, visit http://www.mbsbooks.com.

Course Overview
This course is designed to teach statistics through hands-on experience with real world data and data analyses. The emphasis will be on statistics that are most commonly used in research; you will read, apply, and interpret the statistics you are most likely to encounter in applied research settings. You will learn when to use different statistics, know how to quickly tackle a large data set, become familiar with reading output from computerized statistical programs, interpret effect sizes, and be able to use
an online statistical tool and/or a statistical program to compute averages, variances, and standard deviations.

**Technology Requirements**

Participation in this course will require the basic technology for all online classes at Columbia College:

- A computer with reliable Internet access,
- a web browser,
- ability to watch an online video, such as on YouTube,
- Acrobat Reader,
- Microsoft Office or another word processor such as Open Office.

You can find more details about standard technology requirements for our courses on our site.

**Course Objectives**

- To correctly choose the appropriate statistical test for a given set of data.
- To compute basic descriptive statistics.
- To compute basic parametric and nonparametric statistics.
- To interpret the results of descriptive and inferential statistical analyses.
- To use a packaged computer program (e.g. Statistica, SAS, SPSS, online tools, etc.) to compute statistics.

**Measurable Learning Outcomes**

- Explain the basic research designs, including correlational method and experimental method.
- Define sample and population.
- Describe the four scales of measurement.
- Create simple, relative and cumulative frequency distributions from data sets.
- Describe the characteristics of normal and non-normal distributions of data.
- Calculate measures of central tendency, including mean, median and mode using a scientific online statistical tool and a statistical analysis program.
- Describe when the use of mean, median and mode is appropriate.
- Using a scientific online statistical tool and statistical analysis package, calculate measures of variability, including range, sample and population variances, sample and population standard deviations, estimations of the population variance and standard deviation, and the standard error of the mean.
- Apply the standard deviation to a normal distribution.
- Describe the usefulness of transformed scores.
- Calculate and interpret z-scores, T scores and percentiles.
- Describe correlations between two variables (e.g., negative, positive, none).
- Interpret a scatter plot based on the slope of regression line and the dispersion of data around the line of best fit.
- Calculate a simple regression line and use it for prediction.
- Calculate the standard error of the estimate and demonstrate an understanding of the error in prediction.
- Describe and explain the basics of probability (e.g., region of rejection, alpha level, p).
• Describe and explain statistical hypothesis testing, including rejecting and failing to reject the Null Hypothesis.
• Describe and explain errors in statistical decision-making (i.e., Type I and Type II Errors).
• Define power of a statistical test and the ways in which power can be maximized.
• Calculate and interpret confidence intervals.
• Define independent samples.
• Correctly choose which statistic is appropriate for a given sample, calculate results and interpret, for the z-test and the single-sample t-test.
• Describe and explain when it is appropriate to choose parametric verses non-parametric statistics.
• Describe and explain the logic of an analysis of variance (ANOVA).
• Demonstrate competence for when it is appropriate to choose to calculate post-hoc comparisons (e.g., Tukey Test).
• Calculate post-hoc comparisons using a statistical software program and interpret the results.
• Correctly choose which statistic is appropriate for a given sample and develop a statistical hypothesis to test. Then using a statistical software program, develop a spreadsheet, calculate the main statistic and interpret the result. Next, calculate an effect size/coefficient of determination and interpret the result. This process should be demonstrated for at least 10 of the following statistical tests:
  o Spearman Rank-Order Correlation
  o Pearson Product-Moment Correlation
  o t-test for independent samples
  o t-test for dependent samples
  o one-way ANOVA for independent samples
  o one-way ANOVA for dependent samples
  o two-way ANOVA for independent samples
  o two-way ANOVA for dependent samples
  o mixed design two-way ANOVA
  o Mann-Whitney U test
  o Rank sums test
  o Wilcoxon Test
  o Kruskal-Wallis H
  o Freidman's ANOVA
  o One-way chi-square analysis
  o Two-way chi-square analysis
## Grading

### Grading Scale

<table>
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<tr>
<th>Grade</th>
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<tr>
<td>A</td>
<td>900-1000</td>
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<tr>
<td>B</td>
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### Grade Weights

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<tr>
<td>Homework (Online)</td>
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<tr>
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## Schedule of Graded Assignments

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<td>Discussion 6</td>
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Assignment Overview

Discussion Postings

There will be a weekly online discussion worth 15 points each, and are due by 11:59 PM Central Time on Sunday each week. Your posts should reflect critical thinking about the material. Be creative; apply statistics to your life in this section to make it more interesting. Your answers must be in your own words. If you obtained information from another source, be sure to provide the proper citation. Grades will be based on the quality of contributions, e.g. no fill-in-the-blanks, or true/false questions. In particular, I will be looking for the originality—no duplicate questions, accuracy, and punctuality of your responses. All students are expected to read all posts.

Homework Problems

Each week you will work a set of homework problems to help you comprehend the text readings and become proficient in completing statistical computations and interpretation of inferential statistics. The worksheets describing the problems are in the Content section of the course; you will submit your answers through the quiz tool for automatic scoring and feedback.

You will also find a practice set of problems each week to guide you through the course material. Please use your book and other information provided in the course content as resources when completing the practice problems. You can rework these problems as many times as you like. When you submit your answers, you will receive automatic feedback to help improve your understanding. If you want you can post questions and ask for help on the practice problems in the course Discussions.

Quizzes

During Weeks 1-3 and 5-7, you will take a quiz online to test your knowledge of the material presented in the text. Each quiz will consist of 15 multiple choice questions worth 2 points each and are due by 11:59 PM CT on Sunday.

Midterm

The midterm exam will be given in class during week 4. The exam will include 35 multiple choice questions worth 2 points each combining new questions from the week 4 readings as well as questions over material from Weeks 1-3. There is a 60-minute time limit for the exam.
Final Exam

The final exam for the course will be given in class during Week 8. The exam will cover material from Weeks 1-7 as well as your Week 8 readings and will consist of 75 questions worth 2 points each. There is a 120-minute time limit for the exam. You will not need a calculator or a statistical analysis program such as SSP or Excel for the final exam. All information you need will be supplied in the exam.

Course Schedule

Week 1 – Statistics: Introductions/Basic Math Requirements

Readings (Before Class) - Introduction, Modules 1 and 2

In Class Activities 1 (In Class) - Be prepared to discuss and participate in group activities based on this week’s readings and homework.

Discussion 1 (Online) - Describe yourself in the "Introductions" topic of our class. Please give us more than your name. Include your profession, hobbies, pets, and any additional information you care to share to help us get to know you. Also provide:

- your height
- the mileage on your car or truck
- the number of phones (all kinds) in your home

We'll use this data later in the course.

Homework Set 1 (Online) - Complete Homework Set 1, found in the Quiz section of the course. The first week’s homework is a math review and warm-up; it will help you prepare for the remaining work in the course.

Quiz 1 (Online) - Quiz 1 will consist of 15 questions over this week's readings and will be available in the quizzes area in D2L. The quiz is due by 11:59 PM CT on Sunday.

Week 2 – Variability and Normal Distributions

Readings (Before Class) - Modules 3-4, Review Module 2 to complete Discussion 2

In Class Activities 2 (In Class) - Be prepared to discuss and participate in group activities based on this week’s readings and homework.

Discussion 2 (Online) - What are the four types of scales? Provide original specific examples of each. The last few students to do this really have to rack their brains to come up with original examples, so don’t put it off.

Homework Set 2 (Online) - Complete Homework Set 2, found in the Quiz section of the course. This week’s problems focus on computing summary notation and SSP results.

Quiz 2 (Online) - Quiz 2 will consist of 15 questions over this week's readings and will be available in the quizzes area in D2L. The quiz is due by 11:59 PM CT on Sunday.

Week 3 – Variability and Normal Distributions (cont.)

Readings (Before Class) - Modules 5-6 and Appendix C

In Class Activities 3 (In Class) - Be prepared to discuss and participate in group activities based on this week’s readings and homework.
Discussion 3 (Online) - Summarize the data from the introductions in Week 1, using SSP or EXCEL. Although there are step by step instructions (in English) at the back of your textbook for using Microsoft Excel – it does not cover the graphing functions. Also remember there is a learning curve with first use of Statistical Functions in both software programs. So, using SSP (or Excel) make up tables and graphs for the Heights, Number of Phones and Mileage. You'll have to decide/learn how to choose the right type of chart for that type of data (nominal, ordinal, interval, ratio).

Homework Set 3 (Online) - Complete Homework Set 3, found in the Quiz section of the course. This week's problems focus on computing standard deviations and T-scores and interpreting z-score probabilities.

Quiz 3 (Online) – Quiz 3 will consist of 15 questions over this week’s readings and will be available in the quizzes area in D2L. The quiz is due by 11:59 PM CT on Sunday.

Week 4 – Probability and Hypothesis Testing

Readings (Before Class) - Modules 8-12

In Class Activities 4 (In Class) - Be prepared to discuss and participate in group activities based on this week’s readings and homework.

Discussion 4 (Online) - Select three terms from the Glossary (in the back of the book) and provide your own definitions, using your own words. You cannot use a word someone else has posted ahead of you.

Homework Set 4 (Online) - Complete Homework Set 4, found in the Quiz section of the course. This week's problems focus on computing a t-test and determining the probability of its value.

Midterm Exam (In Class) - The midterm exam will be given in class during week 4. The exam will include 35 multiple choice questions worth 2 points each combining new questions from the week 4 readings as well as questions over material from Weeks 1-3. There is a 60-minute time limit for the exam.

Week 5 – Non Parametric Hypothesis Testing

Readings (Before Class) - Module 22; Review modules 8-12

In Class Activities 5 (In Class) - Be prepared to discuss and participate in group activities based on this week’s readings and homework.

Discussion 5 (Online) - Describe 3 experiments that would use the three different t-tests (One Sample, Correlated Samples, and Independent Groups).

Homework Set 5 (Online) - Complete Homework Set 5, found in the Quiz section of the course. This week's problems focus on computing t-tests, Wilcoxon's Ranked sums, and the Matched-Pairs Signed-Ranks Test.

Quiz 4 (Online) - Quiz 4 will consist of 15 questions over this week's readings and will be available in the quizzes area in D2L. The quiz is due by 11:59 PM CT on Sunday.

Week 6 – Correlation and Multiple Regression

Readings (Before Class) - Modules 18-20. See page 341-342 for the correlation statistic on Excel. Skip pages 325-327 “Calculating the Pearson r...”

In Class Activities 6 (In Class) - Be prepared to discuss and participate in group activities based on this week’s readings and homework.

Discussion 6 (Online) - Describe a situation where you’d need the statistical test (one experiment for each):
- t-test for two independent groups (describe the type of data, and Independent and Dependent Variables carefully)
- Bivariate Correlation Analysis (describe the type of data and the Independent Variable and a single Dependent Variable carefully)
- Z-score analysis (describe the type of data (a standardized test!) and Independent and Dependent Variables carefully)
- ANOVA design (describe the type of data and Independent and Dependent Variables carefully)

**Homework Set 6 (Online)** - Complete Homework Set 6, found in the Quiz section of the course. This week's set focuses on computing a Pearson correlation coefficient and analyzing a set of Ranked data using Wilcoxon's Rank Sum Test.

**Quiz 5 (Online)** - Quiz 1 will consist of 15 questions over this week's readings and will be available in the quizzes area in D2L. The quiz is due by 11:59 PM CT on Sunday.

**Week 7 - Applications of Statistics to more than two groups**

**Readings (Before Class)** - Modules 13-14, 21

**In Class Activities 7 (In Class)** - Be prepared to discuss and participate in group activities based on this week's readings and homework.

**Discussion 7 (Online)** - Post a graph you've found in the popular media. What type of data is represented (type of scale) and what type of graph is it?

**Homework Set 7 (Online)** - Complete Homework Set 7, found in the Quiz section of the course. This week's problems focus on Chi Square Analysis, Goodness of Fit Tests, and ANOVA.

**Quiz 6 (Online)** - Quiz 6 will consist of 15 questions over this week's readings and will be available in the quizzes area in D2L. The quiz is due by 11:59 PM CT on Sunday.

**Week 8- Analysis of Variance & Review**

**Readings (Before Class)** - Review Modules 13-14

**In Class Activities 8 (In Class)** - Be prepared to discuss and participate in group activities based on this week's readings and homework.

**Discussion 8 (Online)** - Submit your answers to these questions:
1. What is more useful for computing and understanding a measure of something, the average deviation or the standard deviation? Why?
2. Why would you use a nonparametric statistic?
3. If two things are correlated, does that mean one thing is causing the other to happen?
4. Describe an experiment requiring the statistic ANOVA for analysis. Describe the Dependent Variable, the Independent Variable, the Levels of the Independent variable, and make sure you are using the correct types of data for each variable.

**Final Exam (In Class)** - The final exam for the course will be given in class during Week 8. The exam will cover material from Weeks 1-7 as well as your Week 8 readings and will consist of 75 questions worth 2 points each. There is a 120-minute time limit for the exam. You will not need a calculator or a statistical analysis program such as SSP or Excel for the final exam. All information you need will be supplied in the exam.
Course Policies

Student Conduct

All Columbia College students, whether enrolled in a land-based or online course, are responsible for behaving in a manner consistent with Columbia College's Student Conduct Code and Acceptable Use Policy. Students violating these policies will be referred to the office of Student Affairs and/or the office of Academic Affairs for possible disciplinary action. The Student Code of Conduct and the Computer Use Policy for students can be found in the Columbia College Student Handbook. The Handbook is available online; you can also obtain a copy by calling the Student Affairs office (Campus Life) at 573-875-7400. The teacher maintains the right to manage a positive learning environment, and all students must adhere to the conventions of online etiquette.

Plagiarism

Your grade will be based in large part on the originality of your ideas and your written presentation of these ideas. Presenting the words, ideas, or expression of another in any form as your own is plagiarism. Students who fail to properly give credit for information contained in their written work (papers, journals, exams, etc.) are violating the intellectual property rights of the original author. For proper citation of the original authors, you should reference the appropriate publication manual for your degree program or course (APA, MLA, etc.). Violations are taken seriously in higher education and may result in a failing grade on the assignment, a grade of "F" for the course, or dismissal from the College.

Collaboration conducted between students without prior permission from the instructor is considered plagiarism and will be treated as such. Spouses and roommates taking the same course should be particularly careful.

All required papers may be submitted for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers may be included in the Turnitin.com reference database for the purpose of detecting plagiarism. This service is subject to the Terms and Conditions of Use posted on the Turnitin.com site.

A plagiarism tutorial is located in the content area of the D2L website. Additionally, work that was completed in a prior course and submitted in the current course will not be accepted.

Non-Discrimination

There will be no discrimination on the basis of sex, race, color, national origin, sexual orientation, religion, ideology, political affiliation, veteran status, age, physical handicap, or marital status.

Disability Services

Students with documented disabilities who may need academic services for this course are required to register with the Coordinator for Disability Services at (573) 875-7626. Until the student has been cleared through the disability services office, accommodations do not have to be granted. If you are a student who has a documented disability, it is important for you to read the entire syllabus before enrolling in the course. The structure or the content of the course may make an accommodation not feasible.

Attendance Policy

Attendance for a week will be counted as having submitted a course assignment for which points have been earned during that week of the session or if the proctoring information has been submitted or the plagiarism quiz taken if there is no other assignment due that week. A class week is defined as
the period of time between Monday and Sunday (except for Week 8, when the week and the course will end on Saturday at midnight). The course and system deadlines are all based on the Central Time Zone.

Email

All students are provided a CougarMail account when they enroll in classes at Columbia College. You are responsible for monitoring email from that account for important messages from the College and from your instructor. You may forward your Cougar email account to another account; however, the College cannot be held responsible for breaches in security or service interruptions with other email providers.

Students should use email for private messages to the instructor and other students. The class discussions are for public messages so the class members can each see what others have to say about any given topic and respond.

Late Assignment Policy

A hybrid class requires regular participation and a commitment to your instructor and your classmates to regularly engage in the reading, discussion and writing assignments. Although most of the communication for this course is asynchronous, you must be able to commit to the schedule of work for the class for the next eight weeks. You must keep up with the schedule of reading and writing to successfully complete the class.

Course Evaluation

You will have an opportunity to evaluate the course near the end of the session. A link will be sent to your CougarMail that will allow you to access the evaluation. Be assured that the evaluations are anonymous and that your instructor will not be able to see them until after final grades are submitted.

Additional Resources

Orientation for New Students

This course is offered online, using course management software provided by Desire2Learn and Columbia College. The Student Manual provides details about taking an online course at Columbia College. You may also want to visit the course demonstration to view a sample course before this one opens.

Technical Support

If you have problems accessing the course or posting your assignments, contact your instructor, the Columbia College Helpdesk, or the D2L Helpdesk for assistance. Contact information is also available within the online course environment.

Online Tutoring

Smarthinking is a free online tutoring service available to all Columbia College students. Smarthinking provides real-time online tutoring and homework help for Math, English, and Writing. Smarthinking also provides access to live tutorials in writing and math, as well as a full range of study resources, including writing manuals, sample problems, and study skills manuals. You can access the
service from wherever you have a connection to the Internet. I encourage you to take advantage of this free service provided by the college.

Access Smarthinking through CougarTrack under Students->Academics->Academic Resources.