

**MONTGOMERY COLLEGE ROCKVILLE CAMPUS**  
**DEPARTMENT OF MATHEMATICS**  
**SYLLABUS – MATH 217 BIOSTATISTICS**

Instructor Information	Course Information
<p><b>Instructor:</b> Ms. Rachel Saidi  <b>Office:</b> SC 250 G  <b>Email:</b> <a href="mailto:Rachel.Saidi@MontgomeryCollege.edu">Rachel.Saidi@MontgomeryCollege.edu</a>  <b>Office Hours:</b></p> <p><b>Classroom/Times:</b></p> <p><b>Blackboard:</b> All course material will be posted here</p> <p><a href="http://www.OpenIntro.org">www.OpenIntro.org</a> : This is a free, open source site to learn R statistical software and load the free pdf of the textbook, <i>Open Intro Stats</i> (Diez)</p>	<p><b>CRN:</b></p> <p><b>No Grade Recorded/Change to Audit:</b></p> <p><b>Withdrawal with a Grade of W:</b></p> <p>If you wish to withdraw from the course at any time, you must do so at the Records Office.</p>

Please use your college email for all communications!

**Biostatistics Education Core Competencies**

1. Ability to apply the process of science: Biology is evidence-based and grounded in the formal practices of observation, experimentation, and hypothesis testing
2. Ability to use quantitative reasoning: Biology relies on applications of quantitative analysis and mathematical reasoning
3. Ability to use modeling and simulation

**Course Description:** This is a course in statistical methods for students in biology and the health sciences. The course will explore foundational concepts and applications in descriptive and inferential statistics including: conditional probability, sampling distribution, estimation, odds ratios, formal probability distributions (e.g., binomial, Gaussian and Poisson), confidence intervals, hypothesis testing (e.g., t-tests, Wilcoxon Signed-Rank Test, ANOVA, chi-square tests), correlation, simple and multiple linear regression, relative risk, and logistic regression. Coursework will rely heavily on technology in order to focus on the applications of statistical concepts and methods within the health sciences and biology areas.

**Prerequisite:** This course will require Pre- or Co-requisite(s): MATH 150 or MATH 170 or MATH 181 or consent of the department

**Materials:**

**Textbooks**

1. Samuels M, Witmer J, and Schaffner A, (2016) *Statistics for the Life Sciences* (5<sup>th</sup> Edition), Boston, MA: Pearson. ISBN: 978-0-321-98957-1
2. Diez D, Barr C, and Cetinkaya-Rundel M, *OpenIntro Statistics* (3<sup>rd</sup> Edition). This biostatistics textbook is **free as a pdf file** and available under a Creative Commons license. [www.OpenIntro.org](http://www.OpenIntro.org)

**Technology:**

The TI-83/83+ or 84/84+ graphing calculator will be used partly for homework and tests, while software such as **R** and **STATKEY** will be used primarily in classwork, labs and class demonstrations. **R** is free and open source statistical software, which is used frequently in the field.

## COURSE REQUIREMENTS

In order to be successful in this course, you will need to log on to the course site at minimum 4 – 5 times per week. While in the course site, you will access lecture notes, powerpoint slides, video clips, and other resources. In addition, the weekly assignments will include:

1. **Homework:** You will have textbook homework assignments EVERY WEEK. You will submit the assignments through Blackboard dropbox assignments. Because this is a 200-level 3-credit course, you should be prepared to spend a **minimum of 6-8 hours per week outside of class** working on homework and studying. If you do not make this commitment, your chance of success is greatly diminished. ***I will check completed assignments every week.***
2. **Quizzes:** You will have short weekly quizzes that follow the textbook problems to ensure you are understanding the material. These quizzes will be submitted through Blackboard dropbox assignments.
3. **R-Labs:** Using [www.OpenIntroStat.com](http://www.OpenIntroStat.com), you will learn to program with R-Statistical Software through weekly labs. You will submit the labs through Blackboard dropbox assignments.
4. **Tests:** There are two in-class tests this semester
5. **Capstone Project:** You will find real data to analyze using statistical techniques and present results to the class.

You are responsible for:

- Answering reading assignment questions (often called warmups, which are due at the very beginning of class)
- Reading/reviewing all notes
- Reading/reviewing all examples
- Practicing more problems from the book when you need to focus on a particularly challenging

**Classwork, R-Labs, and Quizzes:** These assignments and assessments will consist of a mixture of quizzes, R-lab assignments, presentations, classwork, and group work.

### Methods of Evaluation:

Exam 1	15 %
Exam 2	15 %
Quizzes	15 %
Homework	15 %
R-Labs	15 %
Capstone Project	25 %
TOTAL	100%

### Exams / Quizzes

You will be given a zero for every exam missed, and **NO MAKE UPS WILL BE GIVEN**, except in situations of extreme emergencies.

**\*\*\*\*\* The following applies to students who miss at most 2 classes during the semester. If your percentage grade on your final exam is better than that of your worst test, this test's grade may be replaced by your final exam grade. \*\*\***

### Grading Policy and Criteria:

A (90-100%)   B (80-89%)   C (70-79%)   D (60-69%)   F (0-59%)

**Important dates:** If you wish to withdraw from the course at any time, you must do so at the Records Office.

**No Grade Recorded/Change to Audit:**

**Withdrawal with a Grade of W:** \_\_\_\_ --- Failure to do so will result in a grade of F.

**Capstone Project presentations:**

**Make-up Policy:** Only for special circumstances, **one test** might be made up, as long as I am notified on or **before** the test. Otherwise the test will be recorded as a zero.

At the end of the semester, your lowest quiz grade will be dropped – there will be **NO MAKEUP QUIZZES**.

At the end of the semester, your 2 lowest homework grades will be dropped. **No late work will be accepted.**

**Attendance Policy:** You are expected to attend all class sessions, arrive on time and stay for the entire session. *If you are absent more than three times, you may be dropped from the class.* If you decide to drop the class, **you** must submit a drop form to the registrar or you will receive an F. A tardy is arriving late to class or leaving before class has ended, and three tardies count as one absence. **Keep in mind that arriving late for class is disruptive to your fellow students.**

**E-mail Communication Statement:** MC student e-mail is an official means of communication for Montgomery College. Students are responsible for information and announcements sent via MC e-mail, and it is expected that students check their student e-mail regularly. When e-mailing an instructor, it is expected that students use their MC student e-mail account.

**Academic Regulations & Student Code of Conduct:**

All MC students are expected to follow “Academic Regulations” & “Student Code of Conduct” as described in the MC Student Handbook. These regulations and guidelines can be found at:

[www.montgomerycollege.edu/departments/academic/vp/Student\\_PandP.htm](http://www.montgomerycollege.edu/departments/academic/vp/Student_PandP.htm)

**Math Science Center:** You may receive help here from faculty or student tutors. You may also borrow a TI graphing calculator here for one day or for the entire semester. You should take advantage of this excellent resource center.

**Rockville Campus,** Judy Ackerman Learning Center (formerly the Math/Science Center) SW 109 240-567-5200,

Please check for hours. <http://cms.montgomerycollege.edu/AckermanSTEMLearningCenter/>

**Veteran’s Services:** If you are a veteran or on active or reserve status and you are interested in information regarding opportunities, programs and/or services, please visit the Combat2College Web site at

<http://www.montgomerycollege.edu/combat2college/>

**Inclement Weather (Delayed Opening or Closing of the College):** On occasion, Montgomery College will announce a late opening or early closing of a specific campus or the entire college because of weather conditions or other emergencies. Any exams scheduled for a class that is canceled will occur immediately upon return.

- ❖ *If a class can meet for 50% or more of its regularly scheduled meeting time **OR** if the class can meet for 50 minutes or more, **it will meet.***

For the most up-to-date information regarding College openings, closings, or emergencies, all students, faculty, and staff are encouraged to sign up for email and text alerts via Montgomery College ALERT. Registration information is available at [www.montgomerycollege.edu/emergency](http://www.montgomerycollege.edu/emergency)

***Important Student Information Link***

*In addition to course requirements and objectives that are in this syllabus, Montgomery College has information on its web site (see link below) to assist you in having a successful experience both inside and outside of the classroom. It is important that you read and understand this information. The **link below provides** information and other resources to areas that pertain to the following: student behavior (student code of conduct), student e-mail, the tobacco free policy, withdraw and refund dates, disability support services, veteran services, how to access information on delayed openings and closings, how to register for the Montgomery College alert System, and finally, how closings and delays can impact your classes. If you have any questions, please bring them to your professor. As rules and regulations change they will be updated and you will be able to access them through the link. If any student would like a written copy of these policies and procedures, the professor would be happy to provide them. By registering for this class and staying in this class, you are indicating that you acknowledge and accept these policies.*

<http://cms.montgomerycollege.edu/mcsyllabus/>

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**Final Note:** I am available during scheduled office hours and additional hours by appointment. I strongly recommend seeking help. Another useful study method is to form study groups, which I will foster during in-class activities. I look forward to a successful semester with you.

**COURSE OUTLINE:** These dates are **approximate and subject to change**.

Week	Topic	Learning Objectives	Required Readings
#1 Aug 28, 30	Introduction; Displaying Data Graphically	Describe uses of statistics in biology and health sciences Distinguish between quantitative and categorical variables Create frequency distributions, boxplots	Chs 1 & 2 (Samuels) Optional Ch 1 (Diez)
#2 Sept 4, 6	Description of Samples and Populations	Calculate probabilities of an event Apply probability rules Identify and calculate measures of center and dispersion	Chs 2 & 3 (Samuels)
#3 Sept 11, 13	Probability	Determine characteristics of binomial distributions Describe Bayes Theorem; Random Variables	Ch 3 (Samuels) Chs 2 & 3 (Diez)
#4 Sept 18, 20	Distributions for Categorical Data	Determine and describe characteristics of binomial, Poisson, and Gaussian probability distributions; Calculate areas under a Normal curve; Calculate z-scores	Ch 4 (Samuels)
#5 Sept 25, 27	Sampling Distributions	Explain the sampling distribution process Describe and apply the Central Limit Theorem Calculate and interpret parameters of a sampling distribution	Ch 5 (Samuels)
#6 Oct 2, 4	<b>Review, Exam 1</b>		
#7 Oct 9, 11	Foundations for Estimation, Inference and Confidence Intervals for Means	Explain general ideas for statistical estimation and inference in order estimate population means; Calculate standard error for means; Analyze 1- and 2- sample means using t-distributions Calculate and interpret conf. intervals for $\mu$ Compare 2 means and calculate conf. intervals for $\mu_1 - \mu_2$	Ch 6 (Samuels) Optional Ch 4 (Diez)
#8 Oct 16, 18	Hypothesis Testing	Explain the randomization distribution; Calculate and interpret the t-test ; Use the Normal distribution to approximate the binomial distribution; Calculate and interpret results from t-test, Paired-sample t-test and the paired design, Wilcoxon Signed-Rank Test	Ch 7 (Samuels) Optional Ch 5 (Diez)
#9	Estimation,	Explain general ideas for statistical estimation and inference in	Ch 9(Samuels) Optional Ch 6 (Diez)

Oct 23, 25	Confidence Intervals and Hypothesis Testing for Proportions	order to estimate population proportions Calculate and interpret confidence intervals for $p$ ; Compare 2-means and calculate confidence intervals for $p_1 - p_2$	
#10 Oct 30, Nov 1	Categorical Data Relationships	Calculate and interpret a chi-square test for goodness of fit and independence; Identify and calculate proportions for 2 x 2 and r x k contingency tables; define relative risk and odds ratios	Ch 10 (Samuels) Ch 6 (Diez)
#11 Nov 6, 8	<b>Review, Exam 2</b>		
#12 Nov 13, 15	Analysis of Variance and the F-Distribution	Define notation used for one-way analysis of variance Define and calculate means squares within and between groups Explain the F-distribution and derive the ANOVA model Calculate and interpret the F-test	Ch 11 (Samuels) Ch 5 (Diez)
#13 Nov 20	Linear Regression	Explain correlation of two quantitative variables Calculate and interpret linear regression models; <b>THANKSGIVING HOLIDAY – NO CLASS Nov 22</b>	Ch 12 (Samuels) Ch 5 (Diez)
#14 Nov 27, 29	Multiple Regression	Define characteristics and applications for multiple regression models; Calculate interpret multiple variable regression models and techniques for finding best models	Ch 8 (Diez)
#15 Dec 4, 6	Logistic Regression	Define the characteristics and applications for logistic regression; Calculate and interpret models for logistic regression; Wrap up and review for final exam. <b>Capstone project write-ups due</b>	Ch 8 (Diez)
<b>Tues, Dec. 11<sup>th</sup></b>	<b>Final Project Presentations</b>	<b>2:45 – 4:45pm in our regular classroom</b>	

### Highlights of this course that distinguish it from the MATH 117 Introduction to Statistics

1. Examples and applications pertaining to life sciences and biology.
2. Inclusion of conditional probability and applications with Bayes Theorem
3. Examination of binomial, Poisson, and Gaussian probability distributions.
4. Calculating and applying the Wilcoxon Signed Rank Test.
5. Examining and applying one-way analysis of variance, F-distributions and tests, and the ANOVA model.
6. Calculating and applying multiple linear regression.
7. Defining relative risk and odds ratios.
8. Calculating and applying logistic regression models.

### Chapters and topics used in *Statistics for the Life Sciences* text (Samuels)

1. *Introduction*. Statistics and the life sciences, types of evidence, random sampling
2. *Description of samples and populations*. Frequency distributions, descriptive statistics, boxplots, measures of dispersion, statistical inference.
3. *Probability and the binomial distribution*. Introduction to probability and probability rules, density curves, random variables, binomial distribution.
4. *Normal distribution*. Normal curves, areas under a Normal curve, assessing normality.
5. *Sampling Distributions*. Sample mean, central limit theorem, Normal approximation to the binomial distribution.
6. *Confidence Intervals*. Statistical estimation, standard error for means, confidence intervals for one and two means.
7. *Comparison of two independent samples*. Hypothesis testing, randomization distribution, t-test.
8. *Comparison of paired samples*. Paired-sample t-test and CI, paired design, Wilcoxon Signed-Rank test.
9. *Categorical data: one-sample distributions*. Confidence interval for a population proportion, inference for proportions using chi-square goodness of fit test.

10. *Categorical data: relationships*. Chi-square test for 2 x 2 contingency table, independence and association in 2 x 2 contingency table, the r x k contingency table, relative risk and odds ratios.
11. *Comparing the means of many independent samples*. One-way analysis of variance (ANOVA) model, F-distribution and F-test.
12. *Linear Regression and Correlation*. Correlation coefficient, simple linear regression models interpreting regression and correlation.

### Chapters and topics used in *OpenIntro Statistics* text (Diez)

1. *Introduction to data*. Data structures, variables, summaries, graphics, and basic data collection techniques.
2. *Probability (special topic)*. The basic principles of probability. An understanding of this chapter is not required for the main content in Chapters 3-8.
3. *Distributions of random variables*. Introduction to the normal model and other key distributions.
4. *Foundations for inference*. General ideas for statistical inference in the context of estimating the population mean.
5. *Inference for numerical data*. Inference for one or two sample means using the t-distribution, and also comparisons of many means using ANOVA.
6. *Inference for categorical data*. Inference for proportions using the normal and chi-square distributions, as well as simulation and randomization techniques.
7. *Introduction to linear regression*. An introduction to regression with two variables. Most of this chapter could be covered after Chapter 1.
8. *Multiple and logistic regression*. A light introduction to multiple regression and logistic regression for an accelerated course.

\* *OpenIntro Statistics* also includes **R-statistical software** exercises which will be incorporated into the topics. In addition, Duke University offers open course components on <https://www.coursera.org/course/statistics>.

*Data Analysis and Statistical Inference Lectures* are designed to be self-contained, but the course will closely follow *OpenIntro Statistics*, and hence the text can serve as supplementary material to the videos. Instructor: Mine Çetinkaya-Rundel