

Biometry: STAT 02280-3

Rowan University

Fall 2019 – CRN 42979

Prerequisites: Biology 1 & 2 (BIOL 01104 & BIOL 01106, or equivalent) and Calculus I (MATH 01130)

Read this syllabus carefully. It represents a contract between the instructors and students.

| | Lecture | Lab |
|------------------------|---|--|
| Instructor | Catharine Dickerson Department of Mathematics dickerson@rowan.edu Office: 229B Robinson Hall | Dr. Nathan Ruhl Dept. of Biological Sciences ruhl@rowan.edu Office: 201L Science Hall |
| Class Meetings: | Tuesday/Thursday 9:30-10:45am 3102 James Hall | Monday 9:30 – 12:15 234 Science Hall |
| Office Hours | Tuesday 11:00-1:45pm Wednesday 2:00-3:45pm Thursday 11:45am-2:30pm And by appointment | Wednesday 10:00 – Noon And by appointment |

Course Description:

This course provides an introduction to probability and statistics for biology majors. Lecture topics will include descriptive statistics, basic probability, confidence intervals, hypothesis testing, linear correlation and regression, one- and two-way analysis of variance, nonparametric tests, and chi-square tests. Laboratory exercises will reinforce these topics and demonstrate how they are used in biological research. The usage of JMP statistical software to perform analyses will be emphasized.

A. Lecture Materials:

- **Recommended textbook:** Samuels, M., Witmer, J., and Schaffner, A. (2015). Statistics for the Life Sciences (5th ed.). Boston: Pearson/Prentice Hall [ISBN: 978-0-321-65280-5]. While not required, it would be helpful to read the assigned sections in the book before class meetings. The book also contains additional problems you can use for practice.
- **JMP Pro 14 Software:** Nearly all labs and many of the homework assignments in the course require JMP (read as “jump”) statistical software. JMP is available free of charge to Rowan students. Instructions for downloading and installing the program on your personal computer can be found at <https://irt.rowan.edu/services/software/index.html#jmp> Work on assignments well ahead of the due date so that technical issues can be addressed prior to the due date. “Technical difficulties” is not a valid excuse for late or missing assignments.
- **Laptop computer with JMP Pro 14 software installed (at least one laptop per group of 2-3 students).** Beginning during the ninth lecture, we will be using advanced features in JMP. Coordinate with students you would like to collaborate with so that someone in your group has a laptop available. Note: during lab each student is required to bring their own laptop.

- **Texas Instruments graphing calculator: TI-83, TI-84, TI-89, or TI-Nspire.** Plus or Silver editions are fine. If you don't already own a TI graphing calculator, we recommend the TI-84. Bring your calculator to every class meeting.

B. Blackboard:

You can obtain lecture slides, homework assignments/answer keys, handouts, and JMP data files from the Blackboard site for this course. (Go to <https://rowan.blackboard.com>.) Lecture slides are typically posted by at latest the afternoon before lecture. Any updates to the course schedule or assignments will be announced in Blackboard or sent to your Rowan e-mail account. Please check your e-mail at least daily.

If you need a printed copy of a file from Blackboard for class, you are responsible for printing your own copy. Unless announced, instructors will not provide printed copies of course materials.

C. Attendance and Participation:

Attendance and participation may affect borderline course grades, for better or for worse. You are encouraged to ask questions, volunteer answers, and contribute to group/partner activities. Note that you can't participate if you are absent, late for class, or leave class early. Behavior that interferes with class or group activities (i.e. disruptive behavior as outlined in section H.1 of this syllabus) will be noted by the instructor and may negatively influence your participation grade.

While lecture attendance is always expected, emergencies may occasionally prevent you from getting to class. **More than four lecture absences** in a semester (for whatever reason) will result in one letter drop in your course grade (example: B becomes C) unless you have been in communication with Prof. Dickerson about especially challenging circumstances beyond your control.

I do teach another section of this class, Wednesday/Friday 8:00-9:15am. If circumstances prevent you from getting to your regular lecture, you may contact me in advance for permission to attend the other lecture. Permission will be granted no more than twice during the semester, space permitting. Your homework is still due with the rest of your regular section on Tuesday or Thursday (you may turn in homework early).

D. Lecture Homework:

Homework problems are assigned most weeks and a hard copy is due by the beginning of lecture. Lecture homework assignments do not need to be typed if your handwriting is legible. Up to two homework assignments may be submitted by e-mail during the semester (particularly useful if you cannot physically make it to class). Your homework grade will be based on completion, with a demonstrated sincere attempt to complete each problem. Keep in mind that Prof. Dickerson has office hours three days a week if you find yourself stuck on a problem. She can also provide help via e-mail. **Late homework will not be accepted,** although your two lowest homework grades will be dropped. Homework answer keys will be posted on Blackboard following the due date and it is your responsibility to check your answers. If you cannot figure out how you reached an incorrect answer, check with your classmates, send Prof. Dickerson an e-mail, or see Prof. Dickerson during office hours. Many exam questions bear strong resemblance to homework problems.

E. Exams

Two non-cumulative midterms will be given during the semester, each covering roughly a third of the course lecture material in detail. A practice exam will be posted in the week prior to each exam. You will be permitted (and expected) to use your graphing calculator and **one 4"x 6" note card of notes/formulas** during each of these midterms. In the event of a truly unavoidable absence that can be documented, I will weight

your other exams more heavily to compensate for the missed exam. You must contact me as soon as you know that you will be unable to attend an exam and provide me with official, written documentation of the reason for your absence; otherwise, you will receive a "0" for any missed exam (and most likely fail the course).

The final exam will be administered during final exam week. Part of the final exam will cover the last third of the course material in detail (as the midterms did earlier in the course). There will also be a cumulative multiple-choice portion to assess how well you understood and retained the major concepts/ideas covered throughout the semester. As with the midterms, you will be allowed to use your graphing calculator and **one 4"x 6" note card of notes/formulas** on the final exam.

F. Grading and Academic Honesty:

Your course grade will be computed using the following breakdown:

| | |
|---|--|
| Midterms 1 and 2 (15% each) | 30% |
| Final exam | 25% (15% non-cumulative, 10% cumulative) |
| Lecture homework | 13% |
| Lecture participation | 2% |
| Laboratory (see lab syllabus for breakdown) | 30% |

Grading Scale for Course

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

Please note that I have **zero tolerance** for cheating on exams. Cell phones must be stowed out of sight and on silent during exams; peeking at your phone during an exam will result in a score of 0. I use two versions of exams so it will be obvious if you copy off a neighbor's exam. Infractions will be reported to the Provost, in accordance with University policy: <https://confluence.rowan.edu/display/POLICY/Academic+Integrity+Policy>

G. Classroom etiquette and technology policy. All students in this class deserve a distraction-free learning environment. Refrain from side conversations while I am actively lecturing; if you have an on-topic question then please raise your hand so the whole class can benefit from hearing the answer. On-topic discussion with your classmates during group problem-solving time is encouraged.

Phones should be on silent during class (phones on vibrate in backpacks can still be distracting to me and to your classmates). If you are expecting an urgent call/text, put your phone in your pocket on vibrate and quietly excuse yourself from the room to deal with the matter. You should not be using your phone, using your laptop for non-Biometry activities, or sleeping in class since these behaviors are distracting to students around you.

Students partaking in disruptive behavior will be warned. If the disruption persists, students may be asked to leave class in accordance with the University Classroom Behavior Policy:

<https://confluence.rowan.edu/display/POLICY/Classroom+Behavior>

H. Additional Resources for your Academic Success

Starfish

The Rowan Success Network powered by Starfish® is designed to make it easier for you to connect with the resources you need to be successful at Rowan. Throughout the term, you may receive email from the Rowan Success Network team (Starfish®) regarding your academic performance. Please pay attention to these emails and consider taking the recommended actions. Utilize the scheduling tools available through RSN to make appointments (tutoring, advising, etc.) at your convenience. Additional information about RSN may be found at www.rowan.edu/rsn.

Students with Disabilities:

Your academic success is important. If you have a documented disability that may have an impact upon your work in this class, please contact your instructors during the first two weeks of class. Students must provide documentation of their disability to the Academic Success Center in order to receive official University services and accommodations. A directory of resources and instructions on registering for accommodations can be found here: <https://sites.rowan.edu/disabilityresources/index.html>

I. Tentative Lecture Schedule. Changes to this schedule will be announced in class and posted on Blackboard.

| Date | Class Number | Topics and Recommended Reading |
|---------------------------|---------------------------|--|
| T, S3 | Lecture 1 | Intro to Biometry, Data, and Distributions. <i>Read: 1.1, 1.2, 2.1, 2.2</i> |
| R, S5 | Lecture 2 | Describing Numeric Data, part 1 <i>Read: 2.3-2.6</i> |
| M, S9 | Lab: Graphing 1 | Introduction to JMP; displaying data graphically in JMP |
| T, S10 | Lecture 3 | Describing Numeric Data part 2, Begin probability <i>Read: 2.8, 2.9, 3.1</i> |
| R, S12 | Lecture 4 | Finish probability, density curves <i>Read: 3.2, 3.4</i> |
| M, S10 | Lab: Graphing 2 | Summarizing data using JMP |
| T, S17 | Lecture 5 | Normal distributions, assessing normality <i>Read: 4.1, 4.2, 4.4</i> |
| R, S19 | Lecture 6 | Sampling distribution of the mean <i>Read: 5.1-5.3</i> |
| M, S23 | Lab: Random Sampling | Two-variable plots and random sampling |
| T, S24 | Lecture 7 | Confidence interval for a mean <i>Read: 6.1-6.5</i> |
| R, S26 | Lecture 8 | Confidence interval for a proportion <i>Read: 9.1, 9.2</i> |
| M, S30 | Lab: Experimental Design | Central limit theorem; Experimental design |
| T, O1 | Lecture 9 | Confidence interval for a difference in two means <i>Read: 6.7</i> |
| R, O3 | Lecture 10 | Exam 1: covers lectures 1 - 8 |
| M, O7 | Lab: Probability Distrib. | Common probability distributions in biology |
| T, O8 | Lecture 11 | One sample t-test |
| R, O10 | Lecture 12 | Two-sample t-test <i>Read: 7.2, 7.3, 7.5, 7.6, 7.8</i> |
| M, O14 | Lab: Confidence Intervals | Confidence interval for the mean and for the difference between two means |
| T, O15 | Lecture 13 | Paired t-test <i>Read: 8.1-8.3</i> |
| R, O17 | Lecture 14 | Nonparametric tests for two samples <i>Read: 7.10, 8.5</i> |
| M, O21 | Lab: T-tests 1 | One-samples, two-sample, and paired t-tests |
| T, O22 | Lecture 15 | One-way ANOVA, part 1 <i>Read: 11.1-11.4</i> |
| R, O24 | Lecture 16 | One-way ANOVA, part 2 <i>Read: 11.9</i> |
| M, O28 | Lab: T-tests 2 | Communicating Biological Science; ANOVA setup, randomized blocking |
| T, O29 | Lecture 17 | Alternatives to one-way ANOVA <i>Read: 11.5</i> |
| R, O31 | Lecture 18 | Randomized block ANOVA <i>Read: 11.6</i> |
| M, N4 | Lab: Nonparametric tests | Kruskal-Wallis, Rank-Sum, Rank-sign |
| T, N5 | Lecture 19 | Exam 2: covers lectures 9 - 17 |
| R, N7 | Lecture 20 | Two-way ANOVA, part 1 <i>Read: 11.7</i> |
| M, N11 | Lab: Presentations | Oral presentation of primary literature study |
| T, N12 | Lecture 21 | Two-way ANOVA, part 2 |
| R, N14 | Lecture 22 | Correlation and simple linear regression, part 1 <i>Read 12.1-12.3</i> |
| M, N18 | Lab: ANOVA | ANOVA (one-way, two-way, randomized blocks; Tukey-Kramer HSD test) |
| T, N19 | Lecture 23 | Simple linear regression, part 2 <i>Read 12.4-12.6</i> |
| N21 | Lecture 24 | Simple linear regression, part 3 <i>Read 12.7</i> |
| M, N25 | Lab: SLR 1 | Simple linear regression |
| T, N26 | Lecture 25 | Chi-square goodness of fit, begin chi-square for two variables <i>Read 9.4, 10.1</i> |
| R, N28 | No class | <i>Thanksgiving</i> |
| M, D2 | Lab: SLR 2 | Oral Presentation of SLR Study |
| T, D3 | Lecture 26 | Finish chi-square for two variables, Fisher's Exact Test <i>Read 10.2, 10.3, 10.5, 10.6</i> |
| R, D5 | Lecture 27 | Randomization test <i>Read: 7.1</i> |
| M, D9 | Lab: Bringing it Together | Flow-chart of statistical tests |
| T, D10 | Lecture 28 | Review/spillover |
| Final Exam Week- date TBA | | Final Exam (lectures 18-28 in detail; lectures 1-17 major concepts) |