

MERRIMACK COLLEGE  
School of Science and Engineering

**MTH 1505: APPLIED STATISTICS AND PROBABILITY FOR ENGINEERS**

Course Syllabus, Spring 2014

**I. Course Information**

**Instructor:**

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*Office hours:* Mon. 2:30–3:30 p.m., Wed. 2:30–3:30 p.m., Thurs. 4:00–5:30 p.m., or by appointment/drop-in.

**Course details:**

*Name:* MTH 1505: Applied Statistics and Probability for Engineers (4 cr.)

*Class section:* C

*Class meeting times and location:* Tues. and Thurs., 6:00–7:50 p.m.; Mendel 273

*Prerequisites:* MTH 1217 (Calculus I) and MTH 1218 (Calculus II); MTH 1218 may be taken concurrently.

*Course websites:*

- Blackboard: <<https://blackboard.merrimack.edu>>
- McGraw-Hill Connect: <[http://connect.mcgraw-hill.com/class/kaklamanos\\_mth1505\\_s14](http://connect.mcgraw-hill.com/class/kaklamanos_mth1505_s14)>

**Course description (catalog):** An introduction to applied statistical and probability methods in engineering dealing with discrete and continuous variables, joint distributions, estimation, tests of hypotheses, regression, design of experiments and control charts. Statistical computer packages will be used in connection with some of the material studied.

**Course objectives:**

Upon completion of this course, the student will be able to:

1. Analyze data using graphical and numerical summaries.
2. Apply the rules of probability to engineering problems.
3. Calculate probabilities of discrete and continuous random variables using common probability distributions.
4. Calculate probabilities of discrete random variables that are jointly distributed.
5. Compute confidence interval estimates of parameters, and conduct hypothesis tests for statistical inference.
6. Construct and analyze linear regression models.
7. Create and analyze statistical control charts.

**Topical outline** (numbers in parentheses indicate the approximate number of classes):

1. Descriptive statistics (3)
2. Probability rules and random variables (6)
3. Probability distributions (5)
4. Statistical inference (5)
5. Linear regression (3)
6. Statistical quality control (2)

**Textbook:**

*Statistics for Engineers and Scientists (Third Edition) with Connect Access Card*, by William Navidi (2011). McGraw-Hill: New York, N.Y. ISBN: 978-0077987220.

## II. Assessment

**Grading:**

- 20% Midterm Examination I
- 20% Midterm Examination II
- 25% Final Examination
- 10% Quizzes
- 25% Homework

**Exams:** There will be three (3) exams: (1) Midterm Examination I, on Tues., March 4, during class; (2) Midterm Examination II, on Tues., April 15, during class; and (3) the Final Examination, on Tues., May 6, from 6–9 p.m. All exams will draw from material covered in class, homework, and the assigned reading. The format and coverage of each exam will be discussed in class, with sufficient notice.

**Quizzes:** Two (2) quizzes will be administered throughout the semester as an opportunity for you to receive additional feedback. The quizzes will be approximately 20 minutes in length and will be administered at the beginning of class on (1) Thurs., Feb. 13, and (2) Tues., April 1. Both quizzes will be weighted equally when determining your final quiz average, which is worth 10% of the course grade.

**Homework:**

- Each week you will receive an assignment that will usually be divided into (1) homework problems required for submission, and (2) online homework problems.
  1. *Homework problems for submission* will generally be due on Thursday at the beginning of class. Your submission must follow the prescribed format in the “Homework Guidelines” section at the end of this syllabus. These homework problems must be submitted in hard-copy form unless otherwise stated.
  2. *Online homework problems* must be completed using the McGraw-Hill Connect digital teaching and learning environment, which is available once you have purchased a Connect access code. These homework problems will allow you to

- receive additional practice and feedback without the pressure of constructing a formal written solution. These homework problems will generally be due on Friday at 5 p.m.
- Homework assignments will assess material covered in class and in the textbook. Homework problems provide you with practice using the methods covered in class and are essential for you to become proficient with these methods. On some problems, you will gain experience with the statistical computer language and environment R (<<http://www.r-project.org>>). Homework also provides an opportunity to assign more complex and/or thought-provoking problems than those that may be assigned during a timed exam. Remember that the primary purpose of homework is to facilitate learning, not just to produce a solution as the end result.
  - Late homework will be docked by 30 points, and will not be accepted any later than the following Monday at 5 p.m. Should you have extraordinary circumstances, please contact me in advance of the due date. All homework assignments will be weighted equally (unless stated otherwise) when determining your final homework average, which is worth 25% of the course grade.
  - On each homework assignment, you will be allowed to earn 10 points of extra credit by submitting an outline or study guide of the assigned reading material. To receive full credit, an outline should not only be well-written and complete in its coverage, but it should also link the textbook to the material in your class notes. The outline should be submitted with your weekly homework assignment no later than the beginning of class on Thursday.

**Reading:** In the course schedule provided in this syllabus, reading assignments from the textbook are listed for each class session. Reading assignments are to be done before the class for which they are listed, so that you may take an active role in the class and ask any questions to clarify the reading. Homework assignments and exam questions will be drawn heavily from the reading, in addition to material covered during class.

### III. Policies

#### Attendance and class policies:

- To foster active participation in class, I do not permit the usage of cell phones or personal electronics during class sessions. Please turn your cell phone off before the beginning of the session. Also, please do not get up and leave the classroom to make a phone call or visit the washroom in the middle of a lecture, as this is always disruptive to the class.
- Attendance is required at all class sessions, and late entries to class will not be permitted. Each student is allotted two (2) unexcused absences during the course of the semester. For each additional absence in excess of two, the student's final average will be deducted by two points. Each late arrival will be calculated as one-half of an absence.
- On the other hand, I believe that exemplary attendance, punctuality, and participation deserve recognition. At the end of the semester, students who have no unexcused absences, no more than two unexcused late arrivals, and who actively participate in class throughout the semester, will receive two points added to their final average. Usage of personal electronics during class will result in a forfeiture of these points.
- To be excused from class for any planned College-sponsored event, such as an athletic competition, a note must be submitted from the advisor or coach prior to the event. You are

responsible for obtaining class notes or assignments for any session that you miss. To be excused from class because of an extended illness or other emergency, please visit the Hamel Health and Counseling Center.

**Class participation:** This course is intended to be interactive; I will do my best to keep class engaging and entertaining. In-class exercises are designed to help you with the material and to help me determine areas that need more attention. I encourage you to ask questions, both in class and outside class. Please do not hesitate to visit my office, call, or send me an email if you ever have any questions.

**Class honor code:**

- Canon 6 of the National Society for Professional Engineers (NSPE) Code of Ethics states that “Engineers shall conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.” This means that acts of academic dishonesty are unprofessional, unacceptable, and will not be tolerated.
- It is unacceptable to copy the work of another student, whether on exams or homework; such behavior will be grounds for academic disciplinary action, including, but not limited to: zero credit for the assignment in question, a failing grade for the course, suspension from the College, or dismissal from the College. It is also unacceptable to look at prior students’ work or solutions to homework/exam problems that have not been made directly available by the instructor.
- Collaboration is allowed on homework assignments, but all assignments must be written up independently by each student. If you consult with any of your classmates or anyone else, you must indicate their names at the end of the relevant problem(s).
- Students must carefully review the Merrimack College Academic Integrity Code (AIC) distributed in class and available at [http://www.merrimack.edu/about/offices\\_services/office-of-the-provost/academic-integrity-code.php](http://www.merrimack.edu/about/offices_services/office-of-the-provost/academic-integrity-code.php). You will be required to sign an Academic Integrity Pledge during the first week of class, after you have reviewed the Academic Integrity Code and course policies.

**Americans with Disabilities (ADA) Policy:** Please refer to Merrimack’s Disability services website at <https://www.merrimack.edu/campuslife/disability-services.php>.

**General comments:** Please do not hesitate to contact me if you have personal circumstances or issues that I should know about. When in doubt, it is always better to keep me “in the loop” rather than wait until the end of the semester. I hope you enjoy this course, and I look forward to working with you throughout the semester.

## IV. Class Schedule (Tentative)

Note: The class session marked with an asterisk (\*) may need to be rescheduled.

Class No.	Class Title	Date	Textbook Reading
<b>Module 1: Descriptive Statistics</b>			
1	Course Introduction; Overview of Probability and Statistics	Tue. Jan. 21	1.1
2	Summary Statistics	Thu. Jan. 23	1.2
3	Graphical Summaries	Tue. Jan. 28	1.3
<b>Module 2: Probability Rules and Random Variables</b>			
4	Probability Rules; Counting Methods	Thu. Jan. 30	2.1–2.2
5	Conditional Probability and Independence	Tue. Feb. 4	2.3 (pp. 69–76)
6	Total Probability and Bayes' Rule	Thu. Feb. 6	2.3 (pp. 76–84)
7	Discrete Random Variables	Tue. Feb. 11	2.4 (pp. 90–101)
8	Continuous Random Variables; <b>Quiz 1</b>	Thu. Feb. 13	2.4 (pp. 101–111)
9	Linear Combinations of Random Variables; Jointly Distributed Random Variables	Thu. Feb. 20	2.5–2.6 (pp. 116–129)
<b>Module 3: Probability Distributions</b>			
10	Bernoulli and Binomial Distributions	Tue. Feb. 25*	4.1–4.2 (pp. 200–209)
11	Poisson and Other Discrete Distributions	Thu. Feb. 27	4.3–4.4 (all except pp. 223–227)
12	<b>Midterm Examination I</b>	Tue. Mar. 4	—
13	Normal Distribution	Thu. Mar. 6	4.5
14	Exponential and Other Continuous Distributions	Tue. Mar. 11	4.6–4.8 (all except pp. 266–270)
15	Central Limit Theorem	Thu. Mar. 13	4.11
<b>Module 4: Statistical Inference</b>			
16	Confidence Intervals: Introduction; Confidence Intervals for a Single Mean	Tue. Mar. 25	5.1, 5.3
17	Hypothesis Tests: Introduction; Hypothesis Tests for a Single Mean	Thu. Mar. 27	6.1–6.2, 6.4, 6.12

Class No.	Class Title	Date	Textbook Reading
18	Two-Sample Inference: Confidence Intervals; <b>Quiz 2</b>	Tue. Apr. 1	5.4, 5.6–5.7
19	Two-Sample Inference: Hypothesis Tests	Thu. Apr. 3	6.5, 6.7–6.8
20	Inference for Proportions; Conclusion to Statistical Inference	Tue. Apr. 8	5.2, 5.5, 6.3, 6.6
<b>Module 5: Linear Regression</b>			
21	Correlation and Simple Linear Regression	Thu. Apr. 10	7.1–7.2 (all except pp. 518–520)
22	<b>Midterm Examination II</b>	Tue. Apr. 15	—
23	Analysis of Linear Regression Models	Tue. Apr. 22	7.3–7.4
24	Multiple Linear Regression	Thu. Apr. 24	8.1
<b>Module 6: Statistical Quality Control</b>			
25	Statistical Quality Control	Tue. Apr. 29	10.1–10.2
26	Course Conclusion	Thu. May 1	—
—	<b>Final Examination</b>	Tue. May 6, 6–9 p.m.	—

## V. Homework Guidelines

Format:

- Homework assignments should be neat, clear, and accurate. All work is to be done on 8½×11 paper and stapled together.
- On the first page of a homework assignment, please include your name, date, course number (MTH 1505), assignment number and name, and the total number of pages (e.g., “Page 1 of  $n$ ”). On successive pages, include your name (or initials) and page number in the upper right corner.
- Use straightedges, protractors, and/or compasses for all diagrams, sketches and graphs; write legibly and unambiguously in a sequential format down the page.
- Leave an appreciable space (>1 inch) between problems or start each problem on a new page.
- Acknowledge collaboration with fellow students.

Problem-solving procedure:

1. Restate the problem in your own words, including the information that is given and what is to be found. The reader should not have to refer to the textbook or problem assignment.

2. State the fundamental equations and/or principles necessary to solve the problem, as well as any assumptions.
3. Solve the problem (algebraically and/or numerically) to obtain your answer. Provide written explanations to help explain your thought process.
4. Highlight your final answer with a box. Include units and remember the number of significant figures that are appropriate.
5. If necessary, discuss your results and the assumptions used. Check your answer for reasonableness and confirm the consistency of your units.

General comments:

- Neatness and legibility is a requirement for an assignment to be graded. Homework that does not follow these guidelines or that is illegible may be returned with a grade of zero.
- Organization and neatness will be considered in grading, along with procedures and final answer. Show enough equations, sources of information, assumptions and intermediate steps so that your work can be followed both by a grader and by you when you later use the homework for review.
- Your homework submissions should reflect the diligence and thoroughness required in engineering. Consider your homework a professional submittal to your boss. What will happen if he/she cannot read or understand it?