

SYLLABUS

Mathematics 050 will meet on Mondays, Wednesdays, and Fridays
from 11:00 a.m. to 11:50 a.m. in King 243.

TAUGHT BY: Elizabeth Wilmer

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OFFICE HOURS: Monday, 3:30–4:30 p.m.

Tuesday, 11:30 a.m.–12:30 p.m.

Tuesday, 3:00–4:00 p.m.

Thursday, 2:00–3:00 p.m.

IM HOURS: Monday and Tuesday evenings.

GOALS OF THE COURSE: A friendly introduction, complete with examples, applications, discussion, and digression, to two mathematical ways of looking at the world. *Graph theory* describes and classifies networks by their patterns of interconnection. *Probability* is the mathematics of chance. We will use both in examining some issues of current interest, such as the World Wide Web, epidemic propagation, and small-world phenomena.

TEXTS: We will often work from handouts. The bookstore has, and you should buy, *The Pleasures of Probability* (Richard Isaac, Springer, 1995, ISBN 978-0387944159) and *Graphs and Their Uses* (Oystein Ore, Mathematical Association of America, 1996, ISBN 978-0883856352).

CALCULATORS: You will need a scientific calculator for your homework and for in-class activities. Some appropriate models include the Casio fx-260 SOLAR (\$15.99, small and lightweight) or the Sharp EL-501, EL-506, or EL-531 (case colors and prices vary, but under \$20.00). All of the prices are from Amazon.

You may already own a suitable calculator—for example, any graphing calculator will work. Necessary functions, beyond basic arithmetic, include exponentials and logarithms, factorials (look for an $n!$ button), binomial coefficients (probably a nCr button), random numbers, and single-variable statistics (buttons like Σx or σx).

OTHER SUPPLIES: As your homework will often include computations, equations, and diagrams, many of you will choose to hand-write portions of assignments. Colored pens or pencils, rulers, and graph paper may be helpful. Smooth, bright white paper stands up better to repeated erasing than softer, darker papers (this can be a problem with certain recycled notebooks, unfortunately).

EVALUATION: Each of the two in-class exams will be worth 100 points. The final will be worth 200 points. The homework will be worth 200 points. The final project will be worth 100 points.

EXAMS: There will be two in-class exams, on **Friday, October 3** and **Friday, November 14**.

The final exam will be on **Tuesday, December 16, from 9:00 to 11:00 a.m.**

HOMEWORK: There will be one assignment per week. This will generally be due at the beginning of lecture on Wednesday, although a few assignments may be due on other days.

Late assignments will not be accepted (medical emergencies excepted). I will, however, drop your lowest 2 homework scores from consideration in your final grade.

HOMEWORK, CONTINUED: You should staple together multiple sheets of paper and remove all spiral notebook skritchies. I would also appreciate your typing extended prose sections.

The assignments will vary considerably in form. Each week, you can expect some hybrid between:

- a 2-page paper based on recent reading or a bit of library/web research (you might need to look up a reference or find an article with relevant data).
- a typical “math homework”, with computation, explanation, and/or logical argument.
- a technical diagram—perhaps somewhere between a map and a wiring diagram.

You should explain your thought processes in words. When answering mathematical questions or solving word problems, describe your reasoning and explain why your computations are relevant.

I will provide samples in advance of what I expect for some of the more unusual assignments. When appropriate, a solution set will be posted to the course web site after the assignment has been collected.

FINAL PROJECT: Near the end of the semester, I will ask you to complete a final project, working together with a small group of other students. I anticipate that the form of these projects may vary considerably: some groups may do experiments to probe social networks on campus, while others may construct simulations, or explore some properties of the World Wide Web, or read more about some of the topics we’ve examined and report back. You should expect the final project to include a 5-10 page write-up of results. It will be due during the last week of classes.

IF YOU HAVE QUESTIONS: Ask! Stop by at office hours (or make an appointment for a time that’s better for you). Send e-mail. Call.

DOTS, LINES, AND THE HONOR CODE: As your grade for Mathematics 050 will depend on the results of your exams, your homework assignments, and your group projects, you must uphold the Honor Code while completing all three types of work. You are expected to write and sign the Honor Pledge,

“I affirm that I have adhered to the Honor Code in this assignment,”

at the end of each assignment and each exam; at the end of your final project, every member of the group should write and sign the Honor Pledge. The meaning of adhering to the Honor Code differs, however, for the three types of assignments.

THE HONOR CODE AND HOMEWORK: Talking about mathematics is one of the best ways to improve your understanding of the subject, both because other points of view can be illuminating and because conversation requires you to articulate your own ideas.

I encourage you to discuss any of your assignments with other students. Unless otherwise specified, however, *you must write up your work on your own*. Some quick examples:

OKAY: “I wonder if we can figure out this probability by counting how many ways there are to win the game. Pat, do you think that two cases will cover everything?”

NOT OKAY: “Pat, I hate it when you write so small! Is that a 2 or a 7? I’m never going to get this copied by the time class starts!”

OKAY: “I’m not sure I understand what’s going on. Maybe we should try to find another example like this, except where you can’t get from vertex x to vertex y .”

NOT OKAY: “Huh. You have this letter m in your write-up. Maybe I can call it k instead, to make it look different.”

THE HONOR CODE AND PROJECTS: You should be careful to follow the same standards for citation of sources and for originality of your own work when working on the 050 final project as you would for a paper in any other Oberlin class. Be particularly careful when citing electronic sources.

THE HONOR CODE AND EXAMS: You will be expected to work *entirely on your own* during the exams. You will be allowed to use a scientific calculator during exams, but no books or notes.

TENTATIVE COURSE OUTLINE

- I. Graph Theory—dots (vertices) and lines (edges).
 - A. Why graphs? What can graphs model?
 - B. Basic notions.
 - When are two graphs the same? Isomorphism.
 - When can you draw a graph with no edges crossing? Planarity.
 - Degree, distance, connectedness.
 - Algorithms.
 - C. Eulerian graphs: walk on every edge without repeating.
 - D. Hamiltonian graphs: walk on every vertex without repeating.
- II. Probability.
 - A. Basic notions: sample spaces, events. Monty Hall.
 - B. Counting. Birthday problem.
 - C. Conditional probability. Bayes' formula. Medical testing.
 - D. Independence. Monkeys at typewriters.
 - E. Expected value. Gambling. Lotteries.
 - F. Laws of Large Numbers. Gambler's fallacy.
 - G. Central Limit Theorem. Confidence intervals. Polls.
- III. Applications
 - A. How big is the World Wide Web? How do search engines find useful pages?
 - B. Why do social networks seem so connected? How do phenomena (such as diseases or ideas) spread?