

# CSCI 270

## Applied Math Topics for Computer Science

Spring 2026

MFW 2:15–3:25 pm

MEY 184

<http://cs.wheaton.edu/~tvandrun/cs270>

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Or by appointment through Calendly

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### Contents

**CATALOG DESCRIPTION** A selection of mathematical topics with wide applicability to computer science. Combinatorics, discrete and continuous probability, Bayesian reasoning, graph theory, and models of computation. Prerequisites: CSCI 243 and MATH 235. MATH 245 is also recommended.

**TEXTBOOK.** VanDrunen, *Discrete Mathematics and Functional Programming with Python*, Second Edition. Taylor and Francis, 2025. *Note that this is the same textbook as CSCI 243. Other supplemental readings will be provided through Canvas.*

**PURPOSE OF THE COURSE.** This course is designed to be an option for computer science majors to fulfill the “third course” in their supporting courses requirements; that is, this course is an alternative to MATH 236 (Calculus II), MATH 263 (Introduction to Stats), and PHYS 231 (Introductory Physics I). Specifically, this course is a compendium of topics from probability (along with combinatorics and statistics) and graph theory, with a supplemental foray into the theory of computation. That makes course a compendium of topics chosen to support further study in fields such as data science, machine learning, and computational sciences. Moreover, this course is designed to cover knowledge units in the ACM IEEE *Computer Science Curricula 2023* guidelines for mathematical supporting knowledge for computer science that are not covered in other required courses.

**GOALS AND OBJECTIVES.** The goals of this course are that students will be able to

1. Use combinatorics to determine the number of samples in a set.
2. Articulate the definitions of discrete probability.
3. Identify distributions of discrete and continuous random variables.
4. Derive Bayes theorem.
5. Articulate the definitions of and prove results from graph theory
6. Articulate the definitions and main results of the theory of computation.

The objective of the course is that students will be able to

1. Apply the tools of probability and statistics to model real-world phenomena from data.
2. Apply the tools of graph theory to model the structure of information.
3. Describe programming tasks in terms of the theory of computation.

In addition to these, together we have the general objective of seeing probability, graph theory, and the theory of computation as a way of knowing God’s world and a tool for doing good, to God’s glory.

## COURSE OUTLINE.

*"What will you be teaching me, sir?"*

*"Oh, a little of this, a little that," said Dumbledore airily.*

*—J K Rowling, Harry Potter and the Half-Blood Prince*

We use the terms *unit* and *topic* to refer to primary and secondary headings, respectively, in the course outline. Each topic corresponds to one or two class days.

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| I. Discrete Mathematics Review                             | A. Elements of statistical testing         |
| A. Sets, relations, and functions                          | B. Z-tests and $p$ -values                 |
| B. Proof techniques  | C. Confidence intervals                    |
| C. Cardinality and countability                            | VI. Interesting statistical results        |
| II. Combinatorics  | A. The central limit theorem               |
| A. Combinations and permutations                           | B. The weak law of large numbers           |
| B. Pigeonhole principle                                    | C. Benford's law                           |
| III. Discrete Probability                                  | VII. Bayesian Reasoning                    |
| A. Sample spaces and events, and the axioms of probability | A. Bayes's theorem                         |
| B. Sum and product rules                                   | B. Bayesian inference                      |
| C. Conditional, joint, and marginal probability            | VIII. Graph Theory                         |
| D. Discrete random variables                               | A. Basic concepts and terms                |
| E. Expected value and variance                             | B. Proofs of graph results                 |
| F. Common distributions                                    | C. Graph isomorphisms                      |
| IV. Continuous Probability                                 | D. Varieties graphs                        |
| A. Continuous random variables                             | E. Graphs as models of information         |
| B. Correlation   | IX. Theory of Computation                  |
| C. Distributions   | A. Finite automata and Regular expressions |
| V. Hypothesis testing                                      | B. The lambda calculus                     |
|  | C. Undecidability and NP-completeness      |

## Course procedures

*“Well,” said Owl, “the customary procedure in such cases is as follows.”*

*“What does Crustimoney Proseedcake mean?” said Pooh. “For I am a Bear of Very Little Brain, and long words Bother me.”*

*“It means the Thing to Do.”*

— A A Milne, Winnie-the-Pooh

**HOW WE DO THIS COURSE.** This course’s rhythm is typical for a math course, with a set of exercises assigned for most class days. Additionally, each unit has at least one programming assignment. Frequent quizzes, administered through Canvas, enforce the readings and reinforce the concepts from class.

**IMPLEMENTATION PLATFORM.** Code examples, programming assignments are done using Python 3 with Jupyter notebooks as the programming environment. We make extensive use of the `numpy` and `matplotlib` libraries.

**ASSIGNMENTS.** For (almost) every class session, there will be an assignment to be done for the next session. Programming problems should be turned in through Canvas. All other problems are to be done on paper and turned-in in class or to the box outside my office door.

**QUIZZES.** Quizzes will be posted to Canvas. The purpose of the quizzes is verify that students have done the reading, to communicate to students what I think is most important for them to know, and to help students self-assess their comprehension. I encourage you to take the quizzes without looking at notes or the book, but since that isn’t practical to enforce, it isn’t an absolute rule.

**TESTS.** This class has three tests, not explicitly cumulative. The last test is held during the final exam block, Wednesday, May 6, 1:30pm.

**GRADING.** For the purpose of computing semester scores, *homework* refers to the combination of problem-set assignments, programming assignments, and Canvas-administered quizzes. To **pass** this course (receive a grade of D or better), students must achieve at least 50% on the homework and at least a 50% average on tests. For students who have met the minimum requirements, their *semester score* is calculated from their scores on homework, tests, and final exam as

<i>Item</i>	<i>Weight</i>
Homework and quizzes	25
Tests	3 @ 25 each

Letter grades (A–D) will be determined by score clustering. An estimation of semester grade will be given after the second and third tests.

I use the “Gradebook” feature on Canvas only to communicate scores on individual assignments and tests. I do **not** use the Canvas gradebook for my official record-keeping for scores, for calculating semester scores, or determining letter grades. Please **ignore** any grade estimate that Canvas gives you for this course.

## Policies etc

*And yet, in certain ways, the Institute did remind them of other schools: Rote memorization of lessons was discouraged, but required; class participation was encouraged, but rarely permitted; and although quizzes were given every day, in every class, there was always at least one student who groaned, another who acted surprised, and another who begged the teacher, in vain, not to give it.”*

—Trenton Lee Steward, The Mysterious Benedict Society

**ACADEMIC INTEGRITY.** Students are encouraged to discuss homework problems and ideas for solutions. However, your solutions, proofs, and programs must be your own. If you are having trouble debugging a program you have written, you may show it to a classmate to receive help; likewise you may inspect a classmate’s incorrect program to give help. However, you should not

show *correct* code to a classmate, nor should you look at another student's correct code, to give or receive help.

Students should not use Copilot, ChatGPT, or similar tools for anything related to the programming or written assignments in this class.

Homework on which students have violated these rules will not be accepted. Repeated offenses will be handled through the college's disciplinary procedures and may result in failing the course. (See also the College's statement below.)

**ASSIGNMENTS.** Unless otherwise specified, assignments are officially due at the class period after it was assigned. I will collect the assignments at the end of class. However, you are granted an automatic grace period until 5:00 pm that day. Assignments not complete by class time can be put in the instructor's box. If you have not completed the assignment by the end of the grace period (5:00 pm), then turn in what you have at that time for partial credit.

**ATTENDANCE.** Students are expected to attend all class periods. It is courtesy to inform the instructor when a class must be missed.

**EXAMINATIONS.** Students are expected to take all tests, quizzes, and exams as scheduled. In the case where a test must be missed because of legitimate travel or other activities, a student should notify the instructor no later than one week ahead of time and request an alternate time to take the test. In the case of illness or other emergencies preventing a student from taking a test as scheduled, the student should notify the instructor as soon as possible, and the instructor will make a reasonable accommodation for the student. The instructor is under no obligation to give any credit to students for tests to which they fail to show up without prior arrangement or notification in non-emergency situations. The final exam block is Wednesday, May 6, 1:30pm. I do not allow students to take finals early (which is also the college's policy), so make appropriate travel arrangements.

**ACCOMMODATIONS.** If you have a documented need for accommodations, I will have received a letter on your behalf from the Learning and Accessibility Services Office. But *please talk to me* about what accommodations are most useful to you. In particular, if you desire accommodations for test-taking, talk to me a reasonable amount time in advance (say, at least two class periods) so arrangements can be made. (See also the College's statement below.)

**OFFICE HOURS.** My *drop-in* office hours this semester are 3:30–4:30pm each day when classes are in session. Moreover, you can make an appointment through Calendly.

**ELECTRONIC DEVICES.** My intent is for class to be an electronic-device-free zone. **STUDENTS MAY AT NO TIME USE PHONES OR SIMILAR DEVICES FOR ANY PURPOSE DURING CLASS.** Moreover, phones should not be visible at any time during class—do not have your phone out on the table during class. Similarly, please keep all other devices (laptop, tablet, etc) put away. If you absolutely need to check your phone for something, please discreetly step out in to the hall.

*All this, the Lord willing.*

## *College syllabus statements*

The “Academic Information” website referred to below is found at <https://catalog.wheaton.edu/undergraduate/academic-policies-information/academic-information/>

**ACADEMIC INTEGRITY.** (See “Integrity of Scholarship” on “Academic Information” website.)

The Wheaton College Community Covenant, which all members of our academic community affirm, states that, “According to the Scriptures, followers of Jesus Christ will... be people of integrity whose word can be fully trusted (Psalm 15:4; Matt. 5:33-37).” It is expected that Wheaton College students, faculty and staff understand and subscribe to the ideal of academic integrity and take full personal responsibility and accountability for their work. Wheaton College considers violations of academic integrity a serious offense against the basic meaning of an academic community and against the standards of excellence, integrity, and behavior expected of members of our academic community. Violations of academic integrity break the trust that exists among members of the learning community at Wheaton and degrade the College’s educational and research mission.

**ACCOMMODATIONS.** (See “Learning and Accessibility Services” on the “Academic Information” website).

Wheaton College believes that disability is an indispensable part of the diversity of God’s Kingdom. We work to provide equal access to College programs and activities as well as spaces of belonging for students with disabilities. Students are encouraged to discuss with their professors if they foresee any disability-related barriers in a course. Students who need accommodations in order to fully access this course’s content or any part of the learning experience should connect with Learning and Accessibility Services (LAS) as soon as possible to request accommodations <http://wheaton.edu/las> (Student Services Building - Suite 209, [las@wheaton.edu](mailto:las@wheaton.edu), phone 630.752.5615). The accommodations process is dynamic, interactive, and completely free and confidential. Do not hesitate to reach out or ask any questions.

**STUDENT WELLNESS.** Wheaton College professors are often among the first to witness, observe, or become aware of a matter that a student is navigating, which has disrupted their communication pattern, course workflow, and concerning behaviors. If you need support, use the student resource and request form found on the student portal through the Wheaton Gateway. If your faculty believes you need support and care, they will submit a CARES referral form for us to reach out to you. We offer coordinated care, advocacy, resources, encourage engagement, and ongoing support for acute matters you may navigate. Aligning with the attendance policy as outlined in the student handbook, Student Wellness can provide notices of absences when applicable. Likewise, we are here to work with you through circumstances beyond your control. We welcome the opportunity to meet and come alongside you to share information that will keep you well-informed about campus and community resources to aid your holistic health, retention, and academic student success. We are located in the Student Service Building – Suite 218. You may contact us via email at [student.wellness@wheaton.edu](mailto:student.wellness@wheaton.edu) or by phone at 630-72-5941. We are also available by walk-ins or scheduled appointments with either the Resource and Support Specialist, Kedisha Kelly, the Associate Dean, Dr. Carrie Williams, or the Dean, Dr. Toussaint Whetstone.

**BEHAVIOR POLICY**(See “Classroom Demeanor” on the “Academic Information” website).

Appropriate classroom demeanor is expected of all students. A faculty member may remove any student from a class if the student exhibits uncivil conduct, which includes behavior that is disinterested, disengaged, disrespectful, disruptive, defiant, or disturbing.

**GENDER INCLUSIVE LANGUAGE POLICY** (See “Gender Inclusive Language” on the “Academic Information” website).

Please be aware of Wheaton College’s policy on inclusive language, “For academic discourse, spoken and written, the faculty expects students to use gender inclusive language for human beings.”

**EQUITY AND TITLE IX:** Wheaton College instructors help create a safe learning environment on our campus. The College requires employees to report incidents of discrimination, harassment,

and sexual misconduct to the Title IX Coordinators/Equity Officers. When they learn of an incident that may be a crime or may be a violation of the College Nondiscrimination Policies, instructors at the college have a duty to report and are required to share all relevant information with the College. Confidential resources available to students include Confidential Advisors, the Counseling Center, Student Health Services, and the Chaplain's Office. More information on these resources and College Policies is available <http://www.wheaton.edu/equityandtitleIX>.

**WRITING CENTER:** See <https://www.wheaton.edu/academics/services/writing-center/>. The Writing Center is a free resource that equips undergraduate and graduate students across the disciplines to develop effective writing skills and processes. This academic year, the Writing Center is offering in-person consultations in our Center in Buswell Library, as well as synchronous video consultations online. Make a one-on-one appointment with a writing consultant here. <https://wheaton.mywconline.com/>.

**MANDATORY REPORTING:** All employees of the College are mandatory reporters of suspected child abuse and neglect as required by the State of Illinois. Mandated reporters are required to call the Department of Children and Family Services Hotline (1-800-25-abuse) when they have reasonable cause to believe that a child known to them in their professional or official capacity may be an abused or neglected child. Mandated reports should call the Hotline if the alleged victim is a child under the age of 18; the alleged perpetrator is a parent, guardian, relative, caregiver, or any person who lives resides in the same home or who came to know the child through an official capacity or position of trust (ie: teacher, coach or healthcare provider) and; there must be an incident of harm or set of circumstances that would lead a reasonable person to suspect that child was abused or neglected.