Syllabus – CS 212 – Discrete Structures – Spring 2018
MWF 9:10

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OFFICE HOURS: MWF 12:45 - 1:45, Thursday 9:15 - 11:15

COURSE DESCRIPTION: This course focuses on discrete mathematical structures that are essential to computer scientists. In this course, students will develop their analytic and algorithmic thinking skills through practice with propositional and first-order predicate logic, various proof techniques, mathematical and structural induction, sets, functions, sequences, recurrence relations, algorithm analysis and computational complexity, the basics of counting, and an introduction to discrete probability.

REQUIRED ONLINE TEXTBOOK: We will be using a highly interactive online book (a "Zybook") for the course that is available from Zyante Publishing. In addition to providing high-quality textual descriptions, Zybooks require you to be an active participant in your learning by engaging in many interactive learning activities. Do not delay in subscribing to this book:

- Signing in or creating an account at `learn.zybooks.com`
- Entering zyBook code *UWOSHCOMPSCI212NapsSpring2018*
- Clicking Subscribe

The cost to subscribe is $48; any applicable returning student discounts will be applied automatically. Your student subscriptions will be valid through Jun 01, 2018. You may also print PDF versions of each chapter of the book to study from when you are offline. Although the PDF version will not have all the interactivity of your online subscription, it provides a form of permanent access to the book's base material.

Should you have any questions regarding the book, you should find a Help/FAQ icon in the toolbar at the top of the Zybook login page. Clicking that will get you in touch with the support team for the book, and I have found them to be very responsive to questions you might send them. I look forward to meeting you in class.

OTHER REFERENCES: Daily class handouts available by 8:00pm on the day preceding each class on D2L.

Topic Coverage

1. Algorithm analysis and computational complexity
2. Propositional logic
3. First-order predicate calculus
4. A variety of proof techniques
5. Mathematical induction
6. Sets, functions, and relations
7. Recurrence relations
8. Basics of counting
9. Introduction to discrete probability

Learning Outcomes

Given our coverage of these topics, you will be expected to . . .

1. Use the basic principles of propositional and predicate logic to prove logical statements.
2. Prove a mathematical statement using the principle of induction (mathematical, strong and structural).
3. Prove a mathematical statement using an indirect proof (i.e., proof by contradiction, proof by contrapositive).
4. Prove a mathematical statement using a direct proof (i.e., proof by construction).
5. Explain the basics of set theory (union, intersection, complement, subset, cardinality, power set, cross product, equality of two sets).
6. Explain the basics of mathematical functions (definition, composition, domain, range, inverse, injective, surjective) and relations (definition, equivalence, inverse, composition, partial orderings, and total orderings).
7. Given a non-recursive algorithm, determine and express its asymptotic time complexity.
8. Given a recursive algorithm, formulate a recurrence equation that describes its running time.
9. Given a recurrence equation that describes the running time of some algorithm, solve the recurrence relation, using a standard technique such as iteration or the Master Theorem, in order to derive the running time of the algorithm.
10. Explain basic combinatorial principles (combinations, permutations, principle of inclusion-exclusion, pigeonhole principle, binomial coefficients).
11. Identify and apply basic probability concepts.

Course Grading Policies

Your grade for the course will be based on the following weighted factors:

Factor:	**Weight:**
Performance on assigned *Participation Activities* in your Zybook	5%
Performance on assigned *Challenge Activities* in your Zybook	5%
Performance on *POGIL (Process Oriented Guided Inquiry Learning) Activities* that we do in class	5%
Quizzes	10% in total
6-8 Problem Assignments	30% in total
Three Exams:	45% in total

To be sure you understand what is involved in each of these factors ...

- A Zybook participation activity (ZPA) is an activity used in initially learning a topic. A ZPA is a more engaging way of doing your reading assignment before our class period begins. You can get all ZPA points just by completing the assigned activities. If a ZPA involves answering a question, there is no penalty if your answers are wrong the first time (or multiple times) or if you show yourself the answer. Because ZPAs are essentially "reading on steroids", they will be assigned and must be completed *before* we cover that material in greater depth in class. The ZPAs that must be completed before a given class will always be posted in the D2L calendar for CS 212.
- A Zybook challenge activity (ZCA) is a homework problem that is assigned for practice with a concept *after* we have finished covering it in class. Assigned after a class, they must be completed before the next class meeting for you to get credit. Many of the ZCAs are "progressive" in that they require you to work through several levels before you receive full-credit. The ZCAs assigned after a class and due before the next class meeting will always be posted in the D2L calendar for CS 212.
- A POGIL activity occurs during the class period when you will often be assigned to a small group to work collectively on solving some problems. You receive full credit for the activity by being a willing and productive member of your group. If you miss the class when a POGIL activity occurs, you receive no credit for it.
- Each problem assignment is comprised of a set of problems for which you prepare carefully crafted answers in a PDF file that you submit to a D2L dropbox before a deadline specified for the assignment. The PDF file must be prepared using LaTeX, which is a mathematical/scientific document preparation system. Your learning Latex in this course will help tremendously in future CS courses that require similar non-coding assignments.

  Late assignments will be accepted but will be penalized at the rate of 10% of their point value the first day late, *an additional* 20% the second, *an additional* 30% the third ...

  Your work on problem assignments is to be done without consultation or help from other students.
- Quizzes will be given at the end of the class on most Fridays. Exceptions are the first week of the semester, the last week of the semester, and any week in which we have an exam. The best preparation for them is to make sure you have not fallen behind on any of the work or topics that have come before that Friday.
- Each exam will involve a mix of multiple-choice and written problems for which you should be thoroughly prepared by your timely and conscientious efforts on ZPAs, ZCAs, POGIL activities, and problem assignments. Your first exam will be Monday, February 26. The dates of your second and thrid exams will announced at a later time.

  If you are unable to take a scheduled exam, it may be possible to take a make-up exam provided that you do BOTH of the following, which are then subject to my approval:
  - Make arrangements prior to the scheduled exam (for last minute emergencies, telephone me at 424-1388 or leave a message at the computer science office, 424-2068). No after-the-fact notifications will be accepted ... *AND*
  - Have a written medical excuse signed by the attending physician OR have a note of justification from the Dean of Students Office.

  Only one make-up exam will be given. It will be a rigorous comprehensive exam given at an arranged time during the last week of the semester.

  To get the 45% contribution to your grade from the three exams, I will use the formula:

$$E = \frac{2}{9} \times E_{worst} + \frac{4}{9} \times E_{best} + \frac{1}{3} \times E_{other}$$

  where E_{worst} is your worst exam score and E_{best} is your best exam score. Essentially this lessens the effect of a bad exam score by only counting that exam half of your best exam score.

At the end of the term, your work in all of these areas will contribute to a numerical grade for the course based on a 100-point scale. Grade cutoff levels on this final scale are:

A ≥ 92	B ≥ 82	C ≥ 72	D ≥ 62
A- ≥ 90	B- ≥ 80	C- ≥ 70	D- ≥ 60
B+ ≥ 88	C+ ≥ 78	D+ ≥ 68	F < 60