CS 240: Introduction to Discrete Mathematics
Fall 2019

Lecture 1: 105 Psychology, MWF: 9:55 - 10:45 am

Lecture 2: 132 Noland, MWF: 1:20 - 2:10 pm

Lecture 3: 168 Nolan, MWF: 2:25 - 3:15 pm

Instructor: Beck Hasti, hasti@cs.wisc.edu
5375 CS, 263-2622

Office Hours: Monday 11 am - noon
Tuesday 12:30 - 2:30 pm
Wednesday 3:30 - 4:30 pm
and by appointment

URLs

canvas.wisc.edu
piazza.com/wisc/fall2019/compsci240
learn.zybooks.com
pages.cs.wisc.edu/~cs240-1 (includes info about getting started and serves as a place to post updates if Canvas is down)

Course Description

CS 240 gives an undergraduate-level introduction to discrete mathematics geared towards prospective Computer Science and Electrical and Computer Engineering majors. It covers fundamental concepts of mathematics (definitions, proofs, sets, functions, and relations) and focuses on the discrete structures that are ubiquitous in digital computing: integers, bits, strings, graphs, and trees.

The goal of the course is two-fold:

- making you familiar with those structures and related notions that are relevant to computer science, and
- developing your skills to reason rigorously about those structures and notions, especially in an algorithmic context.

Prerequisites

One semester of calculus (Math 221). It will be useful to have some prior programming experience.

Course Content

The material comes from many sources: lecture, on-line readings, zyBook e-text, discussion worksheets, course web site, Piazza discussions.

Course Work

Grades are determined using the following breakdown:

- **Exams (60%):**
  3 unit exams (i.e., not cumulative)
  - Exam 1 (20%): Monday, October 14th, 7:15 pm to 9:15 pm
  - Exam 2 (20%): Monday, November 11th, 7:15 pm to 9:15 pm
  - Exam 3 (20%): Thursday, December 19th, 7:25 pm to 9:25 pm
- **Assignments (35%):**
  350 points coming from written work, on-line quizzes, and zyBooks Challenge Activities divided into approximately 14 assignments (with the first worth 10 points and the rest between 20 and 30 points each)
- **zyBook Participation (5%):**
  divided into 20 equally-weighted sections (each with a due date). Attaining an average of 80% (or better) for the participation activities will result in the student earning the full 5%.

Students must notify the instructor (via an on-line form available on Canvas) of conflicts with any exam during the first three weeks of class.

Full information about late policies, submission procedures, and academic conduct expectations as well as a tentative schedule of due dates is available on Canvas.

Discussion Sessions

Each student attends one discussion section a week. In discussion section the student has the opportunity to get more practice with concepts in the course and solving problems under the direction of one or two TA instructors. Attendance is not required, however, a student can earn 2 assignment points for each discussion section attended. A student must attend the discussion section for which they are registered; missed discussion sections may not be made up.

Topics

The following is a tentative schedule of the topics to be covered (with the approximate number of weeks in parentheses):

- intro and course overview (0.5 week)
- propositions and predicates (1)
- sets (1)
- proof techniques (1)
- induction (1)
- invariants (0.5)
- program correctness (1)
- recursion and structural induction (1)
- recurrences (1)
- asymptotic analysis (1)
- functions and relations (1)
- finite automata and regular expressions (1)
- graphs and trees (1.5)
- counting (1.5)

Course Overview

discrete mathmatics = mathmetic study of discrete structure.

↳ x continious.

discrete structures.

1. can be enumerated: 1st 2nd ect ....
2. in CS: bits, integers, strings, trees, graphs, sets, relation & functions.

Course goals

1. familar with discrete structure
2. reason rigiously. → proof

4 parts
1. logic & proof.
2. Induction & recursion
3. graphs & relations
4. intro combinations

→ logic + proofs
- propositional & predicate logic
- set theory
- proof techniques

→ Inductions & recursion

↳ shows more property holds for all items in a discrete

↳ show holds for 1st elt. structure.

+ proof ~~holds~~ for every $k>0$, $k+1$ holds.

▷ used in program correctness (+ invarients)

↳ recursion - recursive programs & recursive definitions.

↓ structural induction.

↳ program analysis.

how many steps does an algorithm take

asymptotic behaviour & notation

→ graphs & Relations

represent.

- graphs & trees
- functions & relations.
- graph theory
- finite state autometa. - a special kind of graph.
  - connected to regular expressions.

→ Intro to Combinations.

- counting
- permutations
- combinations.

Stable Pairing Problem.

problem:

- N food companies, N mascot.
- each company, mascot has perference list.

E.g.

Company	Mascot
1. brown rice	A Spongbob.
EDCBA	12345
2. apple.	B. Tony the Tiger
BDEAC	31245
3. quinoa	C. Winne the Pooh
CDABE	14253
4. Kale	D. Homer Simpson
BCADE	41253
5. Spinach	E Megamind
CBAED	13542

Disruptive Pair = some mascot and some company prefer each other to their partner

Stable Pair = pairs without disruptive pairs

stable pair exist ? How to find ?

↓

Algothrim. mascot goes to company in the list of perference. and company decide which to choose.

terminate $\leq N^2$ days.

optimal, pessimal