Welcome to CMSC 250
Discrete Structures

Please put laptops away… 

Lecture Slide Disclaimer

This is the only slide you are likely to find during this course that contains verbose paragraphs. **These lecture slides are not intended as a tutorial.** The role of the slides in this course will be:

1. To provide an outline of topics we are covering
2. To allow quick visuals for things that are hard for the instructor to write out by hand

To succeed in this course, you will need to attend every class session and to take notes!

What are “Discrete Structures”?

A **discrete structure** is a collection of objects that are “separated” from one another

In contrast: The real numbers are **continuous**

- Examples of discrete structures
- Examples of continuous structures
- Examples of structures that are neither discrete nor continuous

What Can You Expect in CMSC250?

- Goals
  1. Learn math topics essential for studying C.S.
  2. Learn to understand and write proofs
- Significant work load
- Mathematical rigor
- Challenging homeworks
- Analytical thinking required
- You may surprise yourself…

Course Logistics

- Lecture Tu/Th with me
- Lab M/W with T.A.

- Class webpage (including syllabus)

Unit 1
Propositional Logic

Logic

What is "logic"?

There zillions of different definitions out there. I like this one:

> **Logic** is the study of two things:
>
> 1. The principles of reasoning, focusing on the *structure* of propositions (not their *meaning*)
> 2. Methods and validity of *deduction*

- Why should a Computer Scientist study this?

Statements (or Propositions)

A **statement** (or **proposition**) is a sentence that is either true or false.

- We use variables like “p” or “q” for statements
- Examples (and counterexamples)

Logical Connectives

Conjunction (“and”)	$\wedge$
Disjunction (“or”)	$\vee$
Negation (“not”)	**~** (or sometimes $\neg$)

Used to join statements together

- Examples
- Rules of Precedence

Truth Tables

- What is an “interpretation”?
- How many interpretations are possible for a statement with *n* unique variables?
- What is a “truth table”?
- Truth tables for logical connectives

Practice Translating…

1. I am hungry or I am tired
2. Bob was tall and thin
3. Apples are healthy but fast food is not
4. Neither Jim nor Toby is on fire
5. Either I’m hilarious or you have no sense of humor

Practice Truth Tables…

- p ^ ~q
- (p ^ ~r) $\vee$ (p ^ r)
- (p ^ q) $\vee$ (~q $\vee$ ~p)
- (p ^ ~r) $\vee$ (q $\vee$ ~r)

Logical Equivalence

Two statements are **logically equivalent** if they have identical truth values for every possible interpretation.

- Notation:

  $p \equiv q$

- Can we check if two statements are logically equivalent?