Class 1

Schedule

Before **Thursday's class**: (visit https://uvacs2102.github.io for the web version of these notes with links)

– Join the cs2102 slack group and set up your profile with a pronouncable name (not your UVA email id) (setting up your profile photo is encouraged, but not required).

– Read the Course Syllabus and post any questions or comments you have on it on the course slack group (#general).

– Read the *Introduction* and *Chapter 1: What is a Proof?* from the MCS Book. The book is freely available on-line under a Creative Commons License. Students are strongly encrouaged to print out the readings to read them more effectively on paper.

Before **Friday, 6:29pm**:

– Read, print, and sign the Course Pledge. You should print the PDF version for signing, and submit a scan of your signed pledge using Collab.

– Read Jeremy Kun's *Habits of highly mathematical people*.

– Submit a [Course Registration Survey] form (which includes some questions based on Kun's essay).

Notes and Questions

Why is most of the math used in computer science *discrete*?

Why is most of the math you have used in school previously *continuous*?

What are the differences between how scientists, lawyers, and mathematicians establish "*truth*"?

A *proposition* is a statement that is either ________ or _________.

A *predicate* is a proposition whose truth may depend on the value of variables.

A *theorem* is a ____________ that has been proven true.

A proposition that is believed to be true, but unproven, is called a _____________.

An *axiom* is a proposition that is *accepted to be true*. Axioms are not proven; they are *assumed* to be true.

Definition. A *mathematical proof* of a proposition is a chain of *logical deductions* starting from a set of accepted *axioms* that leads to the proposition.

Rules of Inference

The possible steps that can be used in a proof are logical deductions based on inference rules.

Inference rules are written as:

$$\frac{\textit{antecedents}}{\textit{conclusion}}$$

This means if everything on top of the rule is established to be true, then you can conclude what is on the bottom.

Modus Ponens: To prove Q, (1) prove P and (2) prove that P implies Q.

$$\frac{P, \quad P \text{ IMPLIES } Q}{Q}$$

An inference rule is *sound* if never leads to a contradiction: a proof of **false**.

Complete each rule in a way that makes it sound:

$$\frac{P, \quad P \text{ IMPLIES } Q, \qquad\qquad}{R} \qquad \frac{P, \quad Q \text{ IMPLIES } R, \qquad\qquad}{R}$$

Contrapositive:

$$\frac{P \text{ IMPLIES } Q}{NOT(Q) \text{ IMPLIES} NOT(P)} \qquad \frac{NOT(Q) \text{ IMPLIES} NOT(P)}{P \text{ IMPLIES } Q}$$

