Class 1: What makes it go?

Schedule

Before **Thursday's class**: (visit https://uvacs2102.github.io/class1 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 Mathematics for Computer Science Book by Eric Lehman, F. Thomson Leighton, and Albert R. Meyer (henceforth, "MCS"). 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 (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.

Proof

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

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*. ($P \implies Q$ is a notation for P implies Q).

$$\frac{P, \quad P \implies Q}{Q}$$

An inference rule is *sound* if can never lead to a **false** conclusion.

Which of these inference rules are sound?

$$\frac{P}{Q} \qquad \frac{P, P \implies Q}{false} \qquad \frac{P, NOT(P)}{true} \qquad \frac{P, NOT(P)}{P \implies NOT(P)} \qquad \frac{NOT(P) \implies Q}{NOT(Q) \implies P}$$

Contrapositive:

$$\frac{P \implies Q}{NOT(Q) \implies NOT(P)} \qquad \frac{NOT(Q) \implies NOT(P)}{P \implies Q}$$

Theorem to Prove: If the product of x and y is even, at least one of x or y must be even.

Through violence you may murder a liar but you can't establish truth. Through violence you may murder a hater, but you can't murder hate. Darkness cannot put out darkness. Only light can do that.
Martin Luther King, Jr., *Where Do We Go From Here?*, address to SCLC 16 August 1967

