

## 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 encouraged 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.

## 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:

$$\frac{\text{antecedents}}{\text{conclusion}}$$

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?

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

## Contrapositive:

$$\frac{P \implies Q}{\text{NOT}(Q) \implies \text{NOT}(P)} \quad \frac{\text{NOT}(Q) \implies \text{NOT}(P)}{P \implies Q}$$

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