

Constructive Logic (15-317), Fall 2015

Assignment 0: Natural Deduction

Contact: Michael Coblenz (mcohlenz@cs.cmu.edu)

Due Tuesday, September 8, 2015

Welcome to 15-317, Fall 2015 edition! In this introductory homework assignment, you will practice some basic principles you'll need for the rest of the course. As a special exception to the usual rules, for this homework assignment, you may collaborate with other students in the class on the answers to all of the questions as long as you do your write-up individually.

We STRONGLY SUGGEST that you typeset this homework assignment in \LaTeX so that you learn how to typeset your proofs now, while the problems are easier and you are perhaps less busy. You can find the code for this assignment on the course web page; you can use it as a starting point.

This assignment is due on paper at the beginning of class on the above date.

1 A horse is a horse, of course, of course¹

Task 1 (3 points). In natural deduction, once we've proven something, we can use it as many times as we like.

1. Give a derivation for the following in terms of the inference rule notation given in lecture, being sure to name each rule when you use it:

$$\frac{A \text{ true}}{A \wedge A \text{ true}} \text{ copy}$$

2. Now, we have not formalized notation for this, but we want to show something like this:

$$\frac{A \text{ true}}{A \wedge \dots \wedge A \text{ true}} \text{ many - copies}$$

That is, we can always copy A as many times as we want. In order to do this formally, we will show that we can generate many proofs of the form:

¹https://www.youtube.com/watch?v=y_PZPpWTRTU

$$\frac{A \text{ true}}{\underbrace{A \wedge \dots \wedge A}_{i} \text{ true}} \text{ many-copies}_i$$

Write a paragraph-style proof of the theorem: $\forall i \in \mathbb{N}. \text{many-copies}_i$.

2 Selecting a presidential candidate

Some candidates make valid arguments. Here are two examples of valid claims that one might make. Prove both of them using the inference rule notation from class. As before, be sure to write the names of the rules you're using.

Task 2 (2 points).

$$A \wedge B \supset A \text{ true}$$

Task 3 (5 points).

$$(A \supset (B \wedge C)) \supset (A \supset B) \text{ true}$$