Math 480 Homework 7: An Experiment in LaTex and Logic

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Demonstrating the Basics of Logic While Learning LaTex Typesetting

Abstract

A brief introduction to propositional calculus.

1 Introduction

The project that myself, Jessica Junk and Tanner Missler are working on is the betterment and completion of logic.py modules in the Sage library. In this paper I will go over some basic propositional logic.

2 STOP, READ NO FURTHER IF...

Not mentioned in 1, this paper will not have the following:

1. Formulas of the form $a^2 + b^2 = c^2$
2. Rigorous Mathematical Proofs
3. Theory that underlies any type of nontrivial mathematical concepts.

P	Q	$(P \vee Q)$	R
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	F

Table 1: The corresponding truth table for $(P \vee Q) \rightarrow R$

3 Meat and Potatoes: An Introduction to Propositional Calculus

Let P, Q, R represent any proposition. Let $\rightarrow$ represent implies. Let $\neg$ represent not. Consider the following statement:

$$P \rightarrow \neg P$$

Interpreted in english, the statement reads "P implies not P." In a more concrete example, let P represent the proposition of having oranges. What the above says that if you have oranges, you can't have not oranges. It's converse is also true,

$$\neg P \rightarrow P$$

3.1 Truth Tables

Consider the following statment:

$$(P \vee Q) \rightarrow R$$

For P, Q, R propositions, and $\vee$ representing the phrase 'or'. A truth table is a table that shows the truth or falsity of a given proposition. As stated above, you can either have P or $\neg$ P. Having P corresponds to true, and $\neg$ P false similairily. The truth table goes through all possible truth assignments for P and Q to determine the truth or falsity of R. Table 1 shows just that, toggling all possibilities of Q when P is held true, then all assigments of Q when P is held false. $(P \vee Q)$ only becomes false when both P and Q are both false, and thus we do not have the statement R.