Logic in Coq

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Fall 2018

Today’s music: *Autologic* by Rage Against The Machine
Attendance question

Is every logical proposition either true or false?

A. Yes
B. No
C. Mu
Review

Previously in 3110:
• Functional programming in Coq
• Proofs about simple programs

Today:
• Logic in Coq, at the CS 2800 level
TYPES
Type hierarchy

Prop

Set

Propositions: specify assertions

Programs: specify computations
PROPOSITIONAL LOGIC
Logical connectives

• Implication: $p \rightarrow p$
• Conjunction: $p \land p$
• Disjunction: $p \lor p$
• Negation: $\neg p$
Implication

Print `p_implies_p`.

\[ p_{\text{implies}_p} = \]
\[
\text{fun } (P : \text{Prop}) (P_{\text{assumed}} : P) \Rightarrow P_{\text{assumed}} \]
\[
: \text{forall } P : \text{Prop}, P \rightarrow P
\]

\(p_{\text{implies}_p}\) is a function

first input is a proposition

second input is proof of first input

output is that proof
Coq proofs are functional programs
Logical connectives

- Implication: \( p \rightarrow p \)
- Conjunction: \( p \land p \)
- Disjunction: \( p \lor p \)
- Negation: \( \neg p \)
Upcoming events

• A9 GIST: today, 8pm, Gates 122

This is logical.

THIS IS 3110