

CSE-433 Assignment - *Proofs in Propositional Logic*

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Due at class, Thursday, Sep 22

- For this assignment, do not discuss proof ideas and techniques with your classmates.
- Please write your proofs clearly and legibly.

For each of the following judgments, give a proof in the natural deduction system for propositional logic (without using hypothetical judgments). Annotate each hypothesis with an appropriate label. After completing the proof, analyze your Coq proof script proving the same judgment from your previous assignment and see if your proof script follows the proof steps in your written proof. Revise your Coq proof script if necessary.

Here is an example of proving the judgment $A \supset \neg\neg A$ true:

$$\frac{\frac{\frac{\overline{\neg A \text{ true}}^y}{\perp \text{ true}} \neg I^y}{\neg\neg A \text{ true}} \neg I^x}{A \supset \neg\neg A \text{ true}} \supset I^x$$

Each problem is worth 25 points, with a total of 100 points.

- $((A \vee B) \supset C) \supset ((A \supset C) \wedge (B \supset C))$ true
See Lemma `disj_impl_dist`.
- $((A \supset C) \wedge (B \supset C)) \supset ((A \vee B) \supset C)$ true
See Lemma `disj_impl_dist_inv`.
- $\neg\neg\neg A \supset \neg A$ true.
See Lemma `tneg`.
- $(\neg\neg(A \vee \neg A) \supset (A \vee \neg A)) \supset (A \vee \neg A)$ true
See Lemma `dne_em`.