CSE-433 Assignment - *Proofs in Propositional Logic*

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- 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.

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

$$\dfrac{\dfrac{\dfrac{}{\neg A\ \mathit{true}}\,y \quad \dfrac{}{A\ \mathit{true}}\,x}{\bot\ \mathit{true}}\,\neg\mathsf{E}}{\neg\neg A\ \mathit{true}}\,\neg\mathsf{I}^{y}}{A \supset \neg\neg A\ \mathit{true}}\,\supset\mathsf{I}^{x}$$

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

- $((A \vee B) \supset C) \supset ((A \supset C) \wedge (B \supset C))\ \mathit{true}$

  See Lemma `disj_impl_dist`.
- $((A \supset C) \wedge (B \supset C)) \supset ((A \vee B) \supset C)\ \mathit{true}$

  See Lemma `disj_impl_dist_inv`.
- $\neg\neg\neg A \supset \neg A\ \mathit{true}$.

  See Lemma `tneg`.
- $(\neg\neg(A \vee \neg A) \supset (A \vee \neg A)) \supset (A \vee \neg A)\ \mathit{true}$

  See Lemma `dne_em`.