

# Week 9

## Exercises on counterexamples for first order logic semantics

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1. Consider the following formulas:
  - a)  $\forall x[P(x)] \leftrightarrow \neg\exists x[\neg P(x)]$ ;
  - b)  $\exists y[\forall x[P(x) \rightarrow Q(x, y)]]$ ;
  - c)  $\neg\exists x[P(x)] \leftrightarrow \forall x[P(x)]$ .
2. Which one is a satisfiable, unsatisfiable and valid?
3. There are entailments between these formulas?