

HW 1**Due:** 1 September 2009

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COSC 2300

Read pages 19–24 of chapter 2 of the lecture notes.

The syntax of propositional formulas (we denote the set as \mathcal{P}) can be described by a grammar as follows:

$$\mathcal{P} ::= \perp \mid x \mid \neg\phi \mid \phi \wedge \psi \mid \phi \vee \psi \mid \phi \Rightarrow \psi$$

where

 \perp is a constant symbol, $x \in \mathcal{V}$ is a propositional variable, and $\phi, \psi \in \mathcal{P}$ are meta-variables denoting previously constructed propositional formulas.

The signatures of the constructors are given as follows:

$$\begin{aligned}mk_bot &: \mathcal{P} \\mk_var &: \mathcal{V} \rightarrow \mathcal{P} \\mk_not &: \mathcal{P} \rightarrow \mathcal{P} \\mk_and &: (\mathcal{P} \times \mathcal{P}) \rightarrow \mathcal{P} \\mk_or &: (\mathcal{P} \times \mathcal{P}) \rightarrow \mathcal{P} \\mk_implies &: (\mathcal{P} \times \mathcal{P}) \rightarrow \mathcal{P}\end{aligned}$$

Write the syntax trees and the constructor forms for the following formulas.

1. $((p \vee q) \wedge \neg p) \Rightarrow q$
2. $(p \Rightarrow q) \Rightarrow ((p \wedge r) \Rightarrow q)$
3. $((p \vee q) \wedge (p \Rightarrow q)) \Rightarrow (q \Rightarrow p)$
4. $\neg(p \wedge (\neg p \wedge q))$