

CPRE/SE/COMS 412, COMS 512 HOMEWORK 0

Reminder: present your own work and properly cite any sources used. Solutions should be presented satisfying the *other student viewpoint*. If you need clarification, contact the instructor: asminer@iastate.edu.

Question 1

10 points

In propositional logic, simplify the following expressions, where p is a propositional variable.

$$\mathbf{tt} \rightarrow p \equiv ?$$

$$p \rightarrow \mathbf{tt} \equiv ?$$

$$\mathbf{ff} \rightarrow p \equiv ?$$

$$p \rightarrow \mathbf{ff} \equiv ?$$

Question 2

15 points

In propositional logic, prove that the following expression is a tautology (always true).

$$((a \rightarrow b) \wedge (b \rightarrow c)) \rightarrow (a \rightarrow c)$$

Question 3

10 points

Disprove the conjecture

For any Kripke structure $M = (\mathcal{S}, \mathcal{S}_0, \mathcal{R}, L)$ and any set $\mathcal{X} \subseteq \mathcal{S}$,

$$\mathcal{X} \subseteq \text{PostImage}(\text{PreImage}(\mathcal{X}, \mathcal{R}), \mathcal{R})$$

by finding an example Kripke structure and set \mathcal{X} such that

$$\mathcal{X} \not\subseteq \text{PostImage}(\text{PreImage}(\mathcal{X}, \mathcal{R}), \mathcal{R})$$

Question 4 (optional for 412)

15 points

Prove or disprove the conjecture:

For any Kripke structure $M = (\mathcal{S}, \mathcal{S}_0, \mathcal{R}, L)$ and any set $\mathcal{X} \subseteq \mathcal{S}$,

$$\mathcal{X} \subseteq \text{PreImage}(\text{PostImage}(\mathcal{X}, \mathcal{R}), \mathcal{R})$$