

Question 1: Propositional Logic

(a) Let $p ::=$ I know L^AT_EX, $q ::=$ I can write fancy papers, and $r ::=$ I can write homework assignments.

Translate the following sentence into propositional logic: “If I know L^AT_EX, then I can write fancy papers, homework assignments, or both.”

(b) Write out a truth table for your proposition from part a.

(c) Draw your propositional statement from part a as a circuit (use the Law of Implication to convert all implications into disjunctions).

(d) Prove that your proposition is equivalent to $\neg p \rightarrow (q \rightarrow r)$.

(e) Write your proposition from part a as a Java program.

Question 2: Celebration?

This year is the 311st anniversary of CSE 311. We have decided to buy a cake for the celebration. Johan ate a **quarter** of the slices, Michael ate **half** of them, and Adam crashed the party and stole a **sixth** of the total slices. After these three people took their slices, **three** were left for the other TAs. How many slices was the cake divided into?

Question 2: Sneak Peek

If n is a positive integer (if $n \in \mathbb{N}$), prove that dividing $n(n+1)(n+2)$ by 6 will always produce a positive integer.

Question 3: Yummy

In honor of its new location, Dozen’s Cupcakes is holding a party, where the owners will give out lots of free cupcakes! A day before the party, they noticed that an employee was eating some of their cupcakes and fired him on the spot. As revenge for being fired, the former employee tainted one of the 30 batches of cupcakes for the party with an undetectable poison. Eating even a piece of a tainted cupcake would kill any living being in precisely 23 hours.

Several days ago, the owners caught five mice trying to get into their kitchen, and they are willing to feed pieces of a single cupcake from each batch to the mice to hopefully find the tainted one. Is it possible for them to find the tainted tray in time for the party in 24 hours? If so, how?