CSE 311: Foundations of Computing I
QuickCheck: Logic Solutions (due Thursday, September 25)

0. Fool Me Once. . .

Consider the following sentence:

> *I only left the light on in my office if I rushed home, but I either rushed home or left early.*

(a) Is the sentence a proposition? Explain why or why not.

Solution: This sentence is a proposition. It has a truth value associated to it (i.e. it can be shown to be a true or false statement) and is well-formed (grammatically correct, unambiguous).

(b) Define smaller propositions in preparation for converting the sentence to logical notation.

Solution:

$$p : \text{I left the light on in my office}$$
$$q : \text{I rushed home}$$
$$r : \text{I left early}$$

(c) Convert the sentence to logical notation.

Solution: $(p \to q) \land (q \oplus r)$

Note: Something that seemed to confuse a few people was the ordering of p and q in the logical expression. The proposition states that the light was ONLY left on if I rushed home early. However, I could rush home early and not leave the light on. The causal relationship implied is then that if the light is left on in my office, I must have rushed home. If you're still have trouble with this, build a truth table for statements 1) $p \to q$ and 2) $q \to p$ and check to see when the statement will be violated based on the truth table solution to an implication (See Lecture 1 notes).

(d) Fill in the following truth table for the sentence:

Solution:

p	q	r	$p \to q$	$q \oplus r$	$(p \to q) \land (q \oplus r)$
T	T	T	T	F	F
T	T	F	T	T	T
T	F	T	F	T	F
T	F	F	F	F	F
F	T	T	T	F	F
F	T	F	T	T	T
F	F	T	T	T	T
F	F	F	T	F	F