CSE 191 Recitation

2/6/23 - 2/10/23 - Propositional Logic

What is a proposition?

A **proposition** is a declarative statement
- Come up with some examples…
- Come up with some non-examples…

A **propositional variable** is used to represent propositions
- Usually a single letter, like *p,q,r,s*…

The **truth value** of a proposition is either TRUE or FALSE (but not both)
- May also be written as T/F, 1/0, HIGH/LOW, ON/OFF

Logical Operators

Logical Operators are operators which are used to build *new propositions* from existing ones. The result of applying a logical operator to one or more propositions is also a proposition.

Unary Operators: Operates on one proposition. Example: NOT

Binary Operators: Operates on two propositions. Example: AND, OR, XOR, IF, IFF

Examples

If it is the weekend or it is summer, then I am not in school

1. Identify the atomic propositions
2. Identify the logical operators
3. Write the compound proposition out mathematically

Examples

$$t: p \oplus \neg q \Leftrightarrow r \wedge s$$

1. Come up with some example propositions for p, q, r, s
2. Write out the resulting proposition in English
3. Evaluate the truth value of t for different values of p, q, r, s

Truth Tables

A **<u>truth table</u>** is a table that enumerates all possible truth values of the atomic propositions in a compound proposition, and the corresponding truth value of the compound proposition.

- How many rows would the truth table for t: $p \oplus \neg q \Leftrightarrow r \wedge s$ require?
- Why?

Examples

1. Write out the truth table for $p \Leftrightarrow q$

2. Write out the truth table for $(p \rightarrow q) \wedge (q \rightarrow p)$
   a. What does this say about the relation between $p \Leftrightarrow q$ and $(p \rightarrow q) \wedge (q \rightarrow p)$
   b. What if we didn't include the parentheses?

3. Write out the truth table for $p \oplus q \wedge r$
   a. Be mindful of precedence! (what rows change if we put parentheses around p ⊕ q)