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 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

\[ t: p \oplus \neg q \iff r \land s \]

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 \( p, q, r, s \)
A **truth table** 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 $t: p \oplus \neg q \leftrightarrow r \land s$ require?
- Why?
Examples

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

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

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