CSC 240

LOGIC 1

PROPOSITIONAL LOGIC

A proposition is a statement that is either true or false.

Cheese is good on pizza.

Superman could take Batman in a real fight.

Blue is the best color.

Not Propositions:

Clean your room!

What time is it?

Commands aren't propositions.

Neither are questions.

Implications:

If you play with fire, you'll get burned.

If it rains, you'll get wet.

P => Q

IMPLICATIONS

If you eat too much, you'll feel sick.

	P	Q	P => Q
You ate too much. You feel sick.	T	T	T
You ate too much. You don't feel sick.	T	F	F
You didn't eat too much. You feel sick.	F	T	T
You didn't eat too much. You don't feel sick.	F	F	T

P => Q is false only if P is true and Q is false.

BICONDITIONALS

Biconditional:

I will only eat pizza if it is hot.

You will only get an A if you do your homework.

P <=> Q

I will only eat pizza “if and only if” it is hot.

I will only eat pizza iff it is hot.

The pizza is hot <=> I will eat the pizza.

BICONDITIONALS

You will only get an A iff you do your homework.

	P	Q	P <=> Q
You got an A. You did your homework.	T	T	T
You got an A. You didn't do your homework.	T	F	F
You didn't get an A. You did your homework.	F	T	F
You didn't get an A. You didn't do your homework.	F	F	T

P <=> Q is false if P and Q don't have the same truth values.

DE MORGAN'S LAW

$$\neg (p \vee q) = \neg p \wedge \neg q$$

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WHO CARES

We can use propositional logic to transform statements into symbolic logic, making them easier to prove or disprove.

If x + y = 12, then x ≥ 6 or y ≥ 6

What's the contrapositive?

P => Q

¬ Q => ¬ P

P => (S or R)

¬(S ∨ R) => ¬P

¬S ∧ ¬R => ¬P

Logically Equivalent!
by De Morgan's Law

If x < 6 and y < 6 then x + y ≠ 12

SET COMPLEMENTS

U = The Universal Set

"All the Things"

Alternate Notation:

A^C $\overline{A}$ $A' = \{x \in U \mid x \notin A\}$