Chapter 3
Logic / Section2

Truth Tables

For every statement there are two possible outcomes. (True or False)
When determining if a compound statement is true or false you must use a device called a **truth table.**

TWO key things that you need to know about Truth tables

1) The number of statements determines the number of possible outcomes in a truth table. This number of can be determined by the formula 2 to the n power (2^n), with n = the number of statements. (These possible outcomes are called **cases**.)

2) The number of symbols and statements determine the number of columns that will make up the truth table.

Ex 1 = P

	P
Case 1	T
Case 2	F

Ex 2 = P, Q

	P	Q
Case 1	T	T
Case 2	T	F
Case 3	F	T
Case 4	F	F

Also when dealing with truth tables you must use **Dominance of Connectives** process. Going form the least dominant (negation) to the most dominant (biconditional).

Least dominant	**1. Negation, ~**	**Evaluate first**
	2. Conjunction, ∧; disjunction, ∨	
	3. Conditional, →	
Most dominant	**4. Biconditional, ↔**	**Evaluate last**

Conjunction

Conjunctions can be compared at times to making a promise.

Ex = The sales man promised Sam, her new carpet arrives Monday and her new furniture arrives Friday.

P = Her new carpet arrives Monday and Q = her new furniture arrives Friday.

$P \wedge Q =$

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

$P \wedge \sim Q =$

P	Q	$\sim Q$	$P \wedge \sim Q$
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

When using conjunctions $p \wedge q$ is true only when both p and q are true.
If one is false or both are false, then that case is proven false.

Disjunction

Disjunctions can mean you did one or the other, or you did both.

Ex = Jane orders soup or she orders salad.
P = Jane orders soup, and Q = she orders salad

$P \vee Q =$

P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

$\sim P \vee Q =$

P	Q	$\sim P$	$\sim P \vee Q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

When using a disjunction p q is true when either p is true, q is true, or both p and q are true. Only a case that has both p and q being false then is it false.

Negation

[Reminder}
Negation of a true statement is false, and the negation of a false statement is true.
In negation even the symbols negated.

- ~ Conjunction = disjunction
- ~ Disjunction = conjunction
- ~ Conditional = biconditional
- ~ Biconditional = conditional

Also when you use negation on a conjunction it turns into a disjunction. ~(∧) = ∨
When negation is used on a disjunction it becomes a conjunction. ~(∨) = ∧

Paretic problems to put into truth tables.

1: ~(~P∧Q)

P∨~Q

P	Q	~Q	P∨~Q
T	T	F	T
T	F	T	T
F	T	F	F
F	F	T	T

2: ~(P∨Q)

~P∧~Q

P	Q	~P	~Q	~P∧~Q
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

3: ~(P∧Q)

~P∨~Q

P	Q	~P	~Q	~P∨~Q
T	T	F	F	F
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T