Section 1.2:

Example 1:

p **= T** **Mike was caught cheating in the test**

q **= T** **Mike was suspended from school**

Two variables, 4 possibilities:

a) If Mike was caught cheating, then he will be suspended from school.

b) If Mike was caught cheating, then he will not suspended from school

c) If Mike was not caught cheating, then he will be suspended from school

d) If Mike was not caught cheating, then he will not be suspended from school

	p	q	if p then q $p \rightarrow q$
a)	T	T	T
b)	T	F	F
c)	F	T	T
d)	F	F	T

- **Rule 3: Using the $\rightarrow$ symbol (<u>If</u>), it is always true unless the <u>first</u> is T and the <u>second</u> is F.**

Example 2: Construct the truth table of: $(p \to q) \wedge (q \to p)$

	p	q	if p then q $p \to q$	if q then p $q \to p$	$(p \to q) \wedge$ $(q \to p)$
a)	T	T			
b)	T	F			
c)	F	T			
d)	F	F			

Result:

	p	q	if p then q $p \to q$	if q then p $q \to p$	$(p \to q) \wedge$ $(q \to p)$
a)	T	T	T	T	T
b)	T	F	F	T	F
c)	F	T	T	F	F
d)	F	F	T	T	T

The last column is the same as: $(p \leftrightarrow q)$ which is (*if and only if*) which is **Biconditional**.

- **Rule 4**: Using the $\leftrightarrow$ symbol (**if and only if**), it is true when both are T, or both are F.

Example 3: Translate this argument to symbolic form and construct the truth table and determine if it is a valid argument or not.

If it rains, then the concert will be delayed
The concert was delayed, therefore it rained.

p	q			
T	T			
T	F			
F	T			
F	F			

Example 4: Translate this argument to symbolic form and construct the truth table and determine if it is a valid argument or not.

If you miss the final exam, then you will get a zero for the exam

If you get zero in the final exam, then you will not pass the course.

You did not miss the final exam, therefore you will pass

p	*q*	*r*							
T	T	T							
T	T	F							
T	F	T							
T	F	F							
F	T	T							
F	T	F							
F	F	T							
F	F	F							

Example 5: Translate this argument to symbolic form:

The alarm will sound if and only if smoke or carbon monoxide is in the house

There is no carbon monoxide in the house

Therefore, the alarm will sound if and only if smoke is in the house

Summary for Sections 1.1 and 1.2:

- **Logical Equivalence**: When they have identical truth values under identical truth conditions of the simple statement (*When two statements have identical last column in the truth tables*).

- **Tautology = valid argument**: is a statement that is true for all possible combinations of truth conditions for the component statement (*the elements of the last column are all T)*

- **Contradiction**: is a statement that is false for all possible combinations of truth conditions for the component statement (*The elements of the last column are all F*)

- **Conditional**: $p \rightarrow q$ if p then q

- **Biconditional**: $p \leftrightarrow q$ If and only If p then q

p: The weather is cold $\qquad$ q: You will wear a coat

- **Conditional:** $p \rightarrow q$ if p then q

  If the weather is cold, then you will wear a coat

- **Converse:** $q \rightarrow p$

  If you wear a coat, then the weather is cold

- **Inverse:** $\sim p \rightarrow \sim q$

  If the weather is not cold, then you will not wear a coat

- **Contrapositive:** $\sim q \rightarrow \sim p$

  If you will not wear a coat, then the weather is not cold

				Disjunction *p or q*	*Conjunction* *p and q*	*Conditional* *if p then q*	*Converse* *if q then p*	*Inverse* *if ~q then~ p*	*Contrapostive* *if ~p then~ q*	*Biconditional* *if and only if*
p	q	$\sim p$	$\sim q$	$p \vee q$	$p \wedge q$	$p \rightarrow q$	$q \rightarrow p$	$\sim p \rightarrow \sim q$	$\sim q \rightarrow \sim p$	$p \leftrightarrow q$
T	T	F	F	T	T	T	T	T	T	T
T	F	F	T	T	F	**F**	T	T	**F**	F
F	T	T	F	T	F	T	**F**	**F**	T	F
F	F	T	T	F	F	T	T	T	T	T