

## Section 1.5: Truth Table for the Conditional/Implication statement

The conditional statement (if-then) contains:

- "If" portion (the hypothesis/antecedent)
- "Then" portion (conclusion/consequent)
- Symbolic logic:  $P \rightarrow Q$

### The Conditional ("if – then" statement) Truth Table

Your advisor promises: If you pass math, then you will graduate.

Case 1: If I pass math, then I will graduate. (T) (T)

Case 2: If I pass math, then I will not graduate. (T) (F)

Case 3: If I do not pass math, then I will graduate. (F) (T)

Case 4: If I do not pass math, then I will not graduate. (F) (F)

General Rule for the Conditional Truth Table:

ALL CASES ARE TRUE IN A CONDITIONAL EXCEPT  
WHEN THE ANTECEDENT IS TRUE AND THE CONSEQUENT  
IS FALSE.

\*ORDER IS IMPORTANT\*

Create a Truth Table for each statement

1.  $P \rightarrow Q$

<u>P</u>	<u>Q</u>
T	T
T	F
F	T
F	F

$P \rightarrow Q$
T
F
T
T

2.  $\sim Q \rightarrow P$

<u>P</u>	<u>Q</u>	<u><math>\sim Q</math></u>
T	T	F
T	F	T
F	T	F
F	F	T

$\sim Q \rightarrow P$
T
T
T
F

3.  $(\sim P \rightarrow Q) \wedge \sim Q$

<u>P</u>	<u>Q</u>	<u><math>\sim P</math></u>
T	T	F
T	F	F
F	T	T
F	F	T

$\sim Q$
F
T
F
T

$(\sim P \rightarrow Q)$
T
T
T
F

$(\sim P \rightarrow Q) \wedge \sim Q$
F
T
F
F

4.  $\sim Q \rightarrow \sim P$

<u>P</u>	<u>Q</u>	<u><math>\sim Q</math></u>	<u><math>\sim P</math></u>
T	T	F	F
T	F	T	F
F	T	F	T
F	F	T	T

  

<u><math>\sim Q \rightarrow \sim P</math></u>
T
F
T
T

5.  $(\sim Q \rightarrow P) \wedge \sim P$

<u>P</u>	<u>Q</u>	<u><math>\sim P</math></u>	<u><math>\sim Q</math></u>	<u><math>(\sim Q \rightarrow P)</math></u>	<u><math>(\sim Q \rightarrow P) \wedge \sim P</math></u>
T	T	F	F	T	F
T	F	F	T	T	F
F	T	T	F	T	T
F	F	T	T	F	F

6.  $((P \rightarrow \sim Q) \wedge \sim P) \rightarrow \sim Q$

<u>P</u>	<u>Q</u>	<u><math>\sim P</math></u>	<u><math>\sim Q</math></u>	<u><math>(P \rightarrow \sim Q)</math></u>	<u><math>((P \rightarrow \sim Q) \wedge \sim P)</math></u>	<u><math>((P \rightarrow \sim Q) \wedge \sim P) \rightarrow \sim Q</math></u>
T	T	F	F	F	F	T
T	F	F	T	T	F	T
F	T	T	F	F	T	F
F	F	T	T	T	T	T

7.  $(\sim P \vee Q) \rightarrow R$

<u>P</u>	<u>Q</u>	<u>R</u>	<u><math>\sim P</math></u>	<u><math>(\sim P \vee Q)</math></u>
T	T	T	F	T
T	T	F	F	T
T	F	T	F	F
T	F	F	F	F
F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
F	F	F	T	T

<u><math>(\sim P \vee Q) \rightarrow R</math></u>
T
F
T
T
T
F
T
F

### Individual Truth Value for Implications

1. If  $5 > 10$ , then  $-1 > 6$ . Is this conditional true or false?

$$\textcircled{F} \rightarrow \textcircled{F}$$

2. If Richmond is the capital of Virginia, then Manila is the capital of Iraq. Is this conditional true or false?

$$\textcircled{T} \rightarrow \textcircled{F}$$

3. Given P is a true statement, Q is a false statement, and r is a false statement, is the following true or false?

$$P = T \quad Q = F \quad R = F$$

①  $\sim(P \rightarrow Q) \wedge (\sim R \rightarrow \sim P)$  TRUE OR FALSE?

$$\begin{array}{ccc} \underbrace{T \rightarrow F}_{\sim F} & \wedge & \underbrace{T \rightarrow F}_F \\ T & & F \end{array}$$

②  $(P \wedge \sim Q) \vee \sim(P \rightarrow R)$  TRUE

$$\begin{array}{ccc} \underbrace{T \wedge T}_T & \vee & \underbrace{T \rightarrow F}_F \\ T & & T \end{array}$$

① T