

# Logic Homework Exercises #2 (Conditional/Biconditional Statements)

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**Instructions.** In exercises 1-7 let  $p$  be the statement “It is raining.” and let  $q$  be the statement: “I will play golf.” Write each statement in symbolic form.

1.  $\underbrace{\text{I will play golf}}_q \underbrace{\text{only if}}_{\text{only if}} \underbrace{\text{it is raining}}_p$

Answer:  $q \rightarrow p$

2.  $\underbrace{\text{If}}_{\text{if}} \underbrace{\text{it is raining}}_p \underbrace{\text{then}}_{\text{then}} \underbrace{\text{I will play golf}}_q$

Answer:  $p \rightarrow q$

3.  $\underbrace{\text{It will be raining}}_p \underbrace{\text{if}}_{\text{if}} \underbrace{\text{I play golf}}_q$

Answer:  $q \rightarrow p$

4.  $\underbrace{\text{Rain will be}}_p \underbrace{\text{a necessary and sufficient condition for}}_{\text{necessary and sufficient for}} \underbrace{\text{me not to play golf.}}_{\sim q}$

5.  $\underbrace{\text{Rain will be}}_p \underbrace{\text{a sufficient condition for}}_{\text{is sufficient for}} \underbrace{\text{me not to play golf.}}_{\sim q}$

Answer:  $p \rightarrow (\sim q)$

6.  $\underbrace{\text{It will not rain}}_{\sim p} \underbrace{\text{if and only if}}_{\text{if and only if}} \underbrace{\text{I play golf.}}_q$

Answer:  $(\sim p) \leftrightarrow q$

7.  $\underbrace{\text{My playing golf will be}}_q \underbrace{\text{a necessary and sufficient condition for}}_{\text{necessary and sufficient for}} \underbrace{\text{it to rain.}}_p$

Answer:  $q \leftrightarrow p$

In exercises 8-11 construct a truth table for the statement given.

8.  $(p \leftrightarrow q) \vee r$

$p$	$q$	$r$	$p \leftrightarrow q$	$(p \leftrightarrow q) \vee r$
T	T	T	T	T
T	T	F	T	T
T	F	T	F	T
T	F	F	F	F
F	T	T	F	T
F	T	F	F	F
F	F	T	T	T
F	F	F	T	T

9.  $p \longleftrightarrow (q \vee r)$

$p$	$q$	$r$	$q \vee r$	$p \longleftrightarrow (q \vee r)$
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	T	F
F	T	F	T	F
F	F	T	T	F
F	F	F	F	T

10.  $(\sim p \rightarrow q) \wedge r$

$p$	$q$	$r$	$\sim p$	$\sim p \rightarrow q$	$(\sim p \rightarrow q) \wedge r$
T	T	T	F	T	T
T	T	F	F	T	F
T	F	T	F	T	T
T	F	F	F	T	F
F	T	T	T	T	T
F	T	F	T	T	F
F	F	T	T	F	F
F	F	F	T	F	F

11.  $\sim p \rightarrow (q \wedge \sim r)$

$p$	$q$	$r$	$\sim p$	$\sim r$	$(q \wedge \sim r)$	$\sim p \rightarrow (q \wedge \sim r)$
T	T	T	F	F	F	T
T	T	F	F	T	T	T
T	F	T	F	F	F	T
T	F	F	F	T	F	T
F	T	T	T	F	F	F
F	T	F	T	T	T	T
F	F	T	T	F	F	F
F	F	F	T	T	F	F