

Compound Statements

Math 1001

Quantitative Skills and Reasoning



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Simple and Compound Statements

- A **simple statement** is a statement that conveys a single idea.
- A **compound statement** is a statement that conveys two or more ideas.
- Connecting simple statements with words and phrases such as
 - and
 - or
 - if
 - then
 - if and only ifcreates a compound statement.

Simple and Compound Statements

- Logician George Boole used symbols such as p , q , r , and s to represent statements and the symbols \wedge , \vee , \sim , \rightarrow , and \leftrightarrow to represent connectives.

Statement	Connective	Symbolic Form	Type of Statement
not p	not	$\sim p$	✓Negation
p and q	and \wedge	$p \wedge q$ <i>And</i>	Conjunction
p or q	or \vee	$p \vee q$	Disjunction
If p , then q	If...then	$p \rightarrow q$	Conditional
p if and only if q	if and only if	$p \leftrightarrow q$	Biconditional

Compound Statements in Symbolic Form

- Consider the following simple statements:

- p : I will go to the gym today.
- q : The temperature outside is very cold.
- r : I will not walk in the park today.
- s : The weather is warm.

- Write the following compound statements in symbolic form:

- [The temperature outside is very cold] and [I will go to the gym later.]
 $q \wedge p$
- [The weather is warm] and [I will not go to the gym today.]
 $s \wedge \sim p$
- [I will walk in the park today] or [I will go to the gym.]
 $\sim r \vee p$
- If [the weather is warm], then [I will walk in the park today.]
 $s \rightarrow \sim r$

Compound Statements in Symbolic Form

- Consider the following simple statements:

- p : The match will not take place as scheduled.
- q : The coach is sick.
- r : The players are all well.
- s : The match will not take place outdoors.

- Write the following symbolic statements in words.

- $q \wedge \sim p$ [The ^{q} coach is sick] ^{\wedge} [the match will ^{$\sim p$} take place as scheduled].

- $p \vee s$ [The match will not take place as scheduled] ^{\vee} [the match will not take place outdoors].

- $r \rightarrow \sim p$ [If the ^{r} players are all well] then [the match will ^{$\sim p$} take place as scheduled].

Compound Statements and Grouping

- A compound statement surrounded by parentheses are grouped together.
- Similarly, statements on the same side of a comma are grouped together.

Symbolic Form	English Sentence	Meaning
$p \wedge (q \vee \sim r)$	p , and q or not r .	q and $\sim r$ are grouped together.
$(p \wedge q) \vee r$	p and q , or r .	p and q are grouped together.
$(p \wedge \sim q) \rightarrow (r \vee s)$	If (p and not q) then (r or s .)	p and q are grouped together, and r and s are grouped together.

Translate Compound Statements

- Let p , q , and r represent the following:

- p : You complete your coursework.
- q : You graduate.
- r : You will receive a job offer.

- Write $(p \wedge q) \rightarrow r$ as an English sentence.

If you ^{(p} complete your coursework [^] and ^q graduate, then you will receive a job offer. ^r

- Write “If ^{~p} you do not complete your coursework, then ^{~q} you will not graduate and ^{~r} you will not receive a job offer,” in symbolic form.

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

Truth Value of a Conjunction

- Complete the following Truth Table:

Conjunction

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

- The conjunction $p \wedge q$ is true if and only if both p and q are true.
- Sometimes the word but is used in place of the connective and. The two connectives are equivalent.

Truth Value of a Disjunction

- Complete the following Truth Table:

disjunction

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

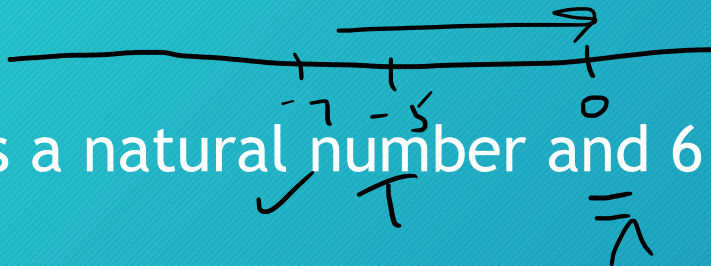
- The conjunction $p \vee q$ is true if and only if both p is true, q is true, or both p and q are true.

Determine the Truth Value

- Determine whether each statement is true or false.

- $-7 \geq -5$

FALSE, -7 is less than -5.



- 6 is a natural number and 6 is an odd number.

FALSE, 6 is not odd.

- 2 is a prime number or 2 is an even number.

T ✓ T

TRUE, 2 is both even and prime.