Chapter 3

Section 3.1

Statements and Quantifiers

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Statements

A _____ is defined as a declarative sentence that is either true or false, but not both simultaneously.

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Statements

A **compound statement** may be formed by combining two or more statements. The statements making up the compound statement are called the **component statements**. Various **connectives** such as *and*, *or*, *not*, and *if...then*, can be used in forming compound statements.

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Examples:

Decide whether each statement is compound.
a) If Amanda said it, then it must be true.
b) The gun was made by Smith and Wesson.

Solution

- This statement is compound.
- This is not compound since *and* is part of a manufacturer name and not a logical connective.

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Example: Forming Negations

Give a negation of each inequality.

a) $p < 3$
b) $3x - 2y \geq 12$

Solution

a) $p \geq 3$
b) $3x - 2y < 12$

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Symbols

$\wedge$

$\vee$

$\sim$

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Examples

Let p represent "It is raining," and let q represent "It is March." Write each symbolic statement in words.

a) $p \vee q$

b) $\sim(p \wedge q)$

Solution

a) It is raining or it is March.

b) It is not the case that it is raining and it is March.

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Examples: Create a Truth Table

Group I: Mary Lynn Brumfield, Mary Smith, Mary Jackson
Group II: Mary Johnson, Lynne Olinde, Margaret Westmoreland
Group III: Donna Garbarino, Paula Story, Rhonda Alessi, Kim Falgout

Statement	Group I	Group II	Group III
All girls in the group are named Mary.			
No girl in the group is named Mary.			
All girls in the group are not named Mary.			
Some girls in the group are not named Mary.			

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Examples: Negations

Statement	Negation of the Statement
All do. (Everyone, Everybody)	Some do not. or Not all do.
Some do.	None do. or All do not. (No one, Nobody)

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Examples: Negations

Form the negation of each statement.

- Some cats have fleas.
- Some cats do not have fleas.
- No cats have fleas.

Solution

- No cats have fleas.
- All cats have fleas.
- Some cats have fleas.

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Sets of Numbers

Natural (*counting*) {1, 2, 3, 4, …}
Whole numbers {0, 1, 2, 3, 4, …}
Integers {…,–3, –2, –1, 0, 1, 2, 3, …}
Rational numbers $\left\{\frac{p}{q} \middle| p \text{ and } q \text{ are integers and } q \neq 0\right\}$

May be written as a terminating decimal, like 0.25, or a repeating decimal like 0.333…
Irrational $\{x \mid x$ is not expressible as a quotient of integers$\}$ Decimal representations never terminate and never repeat.
Real numbers $\{x \mid x$ can be expressed as a decimal$\}$

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Example: Deciding Whether the Statements are True or False

Decide whether each of the following statements about sets of numbers is *true* or *false*.

a) Every integer is a natural number.

b) There exists a whole number that is not a natural number.

Solution

a) This is false, –1 is an integer and not a natural number.

b) This is true (0 is it).

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