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Logic

statement: a sentence that is true or false, but not both (p, q)

truth value: T or F

negation: opposite meaning and opposite truth value

~p

"not p"

Statements are often represented by *p* or *q*.

Ex: p: Arcadia is a city in Ohio. (T)

~p: Arcadia is not a city in Ohio. (F)

Ex: p: Findlay is the capitol of Ohio. (F)

~p: Findlay is not the capitol of Ohio. (T)

compound statement: *two or more statements joined together*

Two Types

1.) Conjunction

    a.) joined with "and"

    b.) $p \land q$ "p and q"

    c.) only T when both are T

Ex: p: December 25th is Christmas. (T)
q: $3 + 4 = 6$ (F)
r: A square has 4 sides. (T)

a.) $p \wedge q$

Dec. 25th is Christmas and $3+4=6$.
$\overset{T}{}\qquad\qquad\qquad\overset{F}{}$

(False)

b.) $r \wedge p$

$T \wedge T$ (T)

2.) Disjunction

    a.) joined with "or"

    b.) $p \lor q$ "p or q"

    c.) only F when both F

Ex: p: $\sqrt{16} = 4$ (T)
q: A triangle has 360°. (F)
r: The radius of a circle is twice
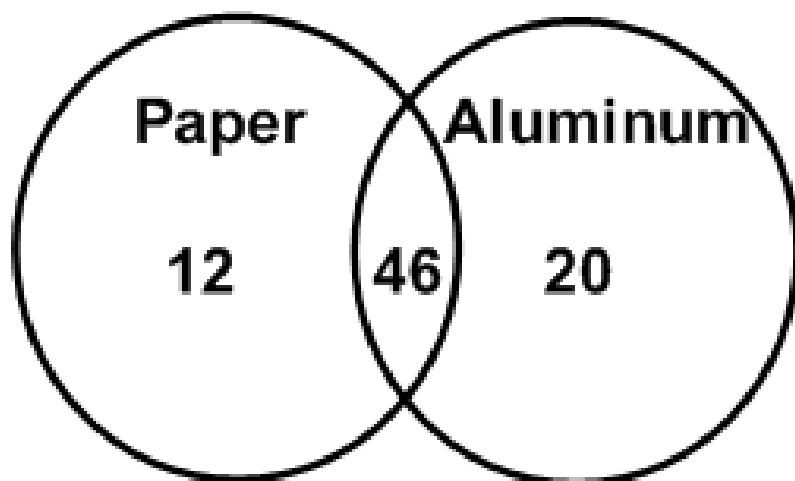the length of the diameter. (F)

a.) p ∨ q

T ∨ F (T)

b.) ~ q ∨ r

~F ∨ F

T ∨ F (T)

Venn Diagrams

Neighborhoods with Curbside Recycling

Paper — 12 | 46 | Aluminum — 20

1.) How many recycle both paper and aluminum? 46

2.) ...paper or aluminum? 78

3.) ...paper and not aluminum?

12

Truth Tables

Negation

p	~p
T	F
F	T

Truth Tables

Conjunction

p	q	p ∧ q
T	T	T
T	F	F
F	T	F
F	F	F

*** only T when both are T

Truth Tables

Disjunction

p	q	p ∨ q
T	T	T
T	F	T
F	T	T
F	F	F

*** only F when both are F

Examples

1.) $p \wedge \sim q$

p	q	~q	p ∧ ~q
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

2.) ~p ∧ ~q

p	q	~p	~q	~p ∧ ~q
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

3.) $(p \land q) \lor r$

p	q	r	$p \land q$	$(p \land q) \lor r$
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	F	T
F	F	F	F	F

Homework:

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