

Math 116
Test 3 Review

Logic

Negations of a statement

1) Negate the following statements

a) All dogs are friendly.

Negation: Some dogs are not friendly.

b) The book is blue.

Negation: The book is not blue.

Types of statement (Conditionals)

Conditional: $A \rightarrow B$

Converse: $B \rightarrow A$

Inverse $\sim A \rightarrow \sim B$

Contrapositive: $\sim B \rightarrow \sim A$

2) Given the statement: If two lines cut by a transversal are parallel, then the corresponding angles formed are congruent.

a) State the converse

If the corresponding angles formed are congruent, then the two lines cut by a transversal are parallel.

b) State the inverse

If two lines are cut by a transversal are not parallel, then the corresponding angles are not congruent.

c) State the contrapositive

If the corresponding angles formed are not congruent, then the two lines cut by a transversal are not parallel.

Truth Tables

3) Complete each truth table

a) $(A \vee \sim B) \rightarrow \sim A$

A	B	$\sim B$	$\sim A$	$(A \vee \sim B)$	$(A \vee \sim B) \rightarrow \sim A$
T	T	F	F	T	F
T	F	T	F	T	F
F	T	F	T	F	T
F	F	T	T	T	T

b) $\sim B \rightarrow (A \wedge B)$

A	B	$\sim B$	$(A \wedge B)$	$\sim B \rightarrow (A \wedge B)$
T	T	F	T	T
T	F	T	F	F
F	T	F	F	T
F	F	T	F	F

4) Show that $A \rightarrow B$ and $\sim A \vee B$ are equivalent statements.

$A \rightarrow B$

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

$\sim A \vee B$

A	B	$\sim A$	$\sim A \vee B$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

Since the two statements get the same result in their truth tables the arguments are equivalent.

- 5) Write the argument in symbolic form, then determine if the following argument is valid or invalid

If Jane does her Calculus homework every night, then she will do well in her Calculus class. $A \rightarrow B$

Jane did not do well in her Calculus class $\sim B$

Therefore, Jane did not do her Calculus homework every night $\sim A$

Solution:

If Jane does her Calculus homework every night, then she will do well in her Calculus class. $A \rightarrow B$

Jane did not do well in her Calculus class $\sim B$

Therefore, Jane did not do her Calculus homework every night $\sim A$

Argument in symbolic form: $((A \rightarrow B) \wedge \sim B) \rightarrow \sim A$

A	B	$\sim A$	$\sim B$	$A \rightarrow B$	$((A \rightarrow B) \wedge \sim B)$	$((A \rightarrow B) \wedge \sim B) \rightarrow \sim A$
T	T	F	F	T	F	T
T	F	F	T	F	F	T
F	T	T	F	T	F	T
F	F	T	T	T	T	T

Since the argument is a tautology, the argument is valid

- 6) Negate using De Morgan's Law

a) $A \vee \sim B$

$$\sim (A \vee \sim B)$$

Solution: $\sim A \wedge \sim (\sim B)$

$$\sim A \wedge B$$

b) $\sim A \wedge \sim B$

$$\sim (\sim A \wedge \sim B)$$

Solution: $\sim (\sim A) \vee \sim (\sim B)$

$$A \vee B$$

7)

Let $A = \{a, b, c, d, e, f\}$, $B = \{a, b, c, d\}$, $C = \{c, d, e, f, g, h\}$, $D = \{b, d\}$

$U = \{a, b, c, d, e, f, g, h, i, j, k, l, m\}$

a) Find $A \cup B$

$\{a, b, c, d, e, f\}$

b) Find $A \cap C$

$\{c, d, e, f\}$

c) Is $C \subset A$?

No

d) Is $B \subset A$?

Yes

e) What is $n(A)$

$n(A) = 6$

f) What is $n(A \cup B)$

$n(A \cup B) = 6$

g) Find A'

$A' = \{g, h, i, j, k, l, m\}$

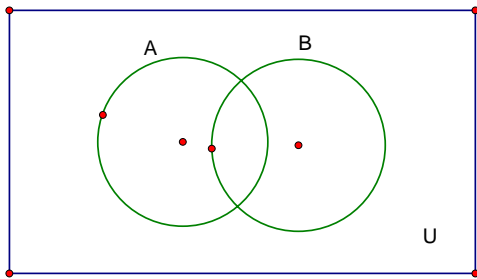
7) List all the subsets of the set $\{0,1\}$

$\{0\}, \{1\}, \{0,1\}, \emptyset$

8) How many subsets does a set with 13 elements have?

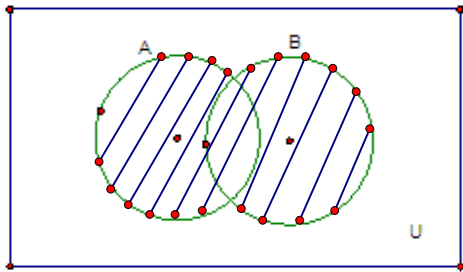
$2^n = 2^{13} = 8192$

9) For each set below, shade the appropriate region on the Venn diagram.



- a) $A \cup B$
- b) $A' \cap B'$

a)



b)

