

Math 114

Logic Unit

Test Review

1) Fill in the blank

Connector	Symbol
Or	\vee
And	\wedge
If-then	\rightarrow
Negation	\sim

Negation each statement

2) All cats are friendly

Answer: Some cats are not friendly

3) John likes ice cream.

Answer: John does not like ice cream

Using the symbolic representations

p: The cat is friendly

q: The cat is playful

Express the following compound statements in symbolic form.

a) The cat is friendly and the cat is playful

$$p \wedge q$$

b) Either the cat is playful or the cat isn't friendly

$$q \vee \sim p$$

c) If the cat is playful, then the cat is friendly.

$$q \rightarrow p$$

Complete the each true table.

4) $p \vee q$

P	Q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

5) $p \wedge q$

P	Q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

6) $p \rightarrow q$

p	Q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Complete each truth table

7) $(p \vee q) \rightarrow \sim p$

p	q	$p \vee q$	$\sim p$	$(p \vee q) \rightarrow \sim p$
T	T	T	F	F
T	F	T	F	F
F	T	T	T	T
F	F	F	T	T

8) $(p \wedge q) \rightarrow q$

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

Validity

- 1) Write the argument in symbolic form, then determine if the argument is valid

p: you exercise regularly

q: you are healthy

If you are healthy, you exercise regularly.

You don't exercise regularly

Therefore, you are not healthy.

If you are healthy, you exercise regularly. $q \rightarrow p$

You don't exercise regularly ($\sim p$)

Therefore, you are not healthy. ($\sim q$)

$(q \rightarrow p) \wedge (\sim p)$: hypothesis

$(\sim q)$: conclusion

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

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

The argument is not valid

Determine if the argument uses inductive reasoning or deductive reasoning

- 1) Math 114 is a math course

Math courses are fun

Math 114 is fun

Deductive reasoning

- 2) John had a chemistry quiz on Monday.

John had a chemistry quiz on Wednesday

Therefore, John will have a quiz on Friday

Inductive reasoning

Solutions to the test 1 Review

Test 1 Review (Math 114) Radford University

Solutions

I) Reasoning and statements

1) Do the following arguments use deductive reasoning or inductive reasoning

- a) Stan noticed that a plane flew over his house at 5:00 PM Monday
Stan noticed that a plane flew over his house at 5:00 PM Tuesday
Stan noticed that a plane flew over his house at 5:00 PM Wednesday
Therefore, Stan concludes that a plane will fly over his house everyday at 5:00 PM

(Inductive reasoning)

- b) All mountain ranges are scenic.
The Blue Ridge Mountains are a mountain range
Therefore, the Blue Ridge Mountains are scenic.

(Deductive reasoning)

2) Negate the following statements.

- a) All trees have green leaves

Negation: Some trees do not have green leaves

- b) Some food at Greasy Nicks taste good.

Negation: All food at Greasy Nicks does not taste good.

- c) John loves to play football

Negation: John does not love to play football

II) Complete a truth table for each statement

3) $p \vee \sim q$

Solution:

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

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

Solution:

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

5) $(\sim q \vee p) \wedge q$

Solution:

p	q	$\sim q$	$(\sim q \vee p)$	$(\sim q \vee p) \wedge q$
T	T	F	T	T
T	F	T	T	F
F	T	F	F	F
F	F	T	T	F

III) Use De Morgan's Law to negate each statement

6) $p \wedge q$

Negation: $\sim (p \wedge q) = \sim p \vee \sim q$

7) $\sim p \vee \sim q$

Negation: $\sim (\sim p \vee \sim q) = \sim (\sim p) \wedge \sim (\sim q) = p \wedge q$

IV) Determine if the argument is valid or invalid.

8) If John studies for his math test, he will pass the math test. $p \rightarrow q$

John did not pass his math test $\sim q$

Therefore, John did not study for his math test $\sim p$

Argument: $((p \rightarrow q) \wedge \sim q) \rightarrow \sim p$

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

Valid argument

9) If you work hard, then you will go far in life $p \rightarrow q$

You work hard p

Therefore, you will go far in life. q

Argument: $((p \rightarrow q) \wedge p) \rightarrow q$

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

This argument is a tautology, so the argument is valid