Matthew Macauley **clemson-math4190**
Assignment online_HW_5_logic due 05/24/2019 at 11:59pm EDT

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1. **(2 points)** `Library/NAU/setFoundations/MAT320_0101.pg`

Determine which of the following is a proposition.

A. $x > 3$
B. $2 > 3$
C. $2x + 11 = 23$

Answer: ___

Determine which of the following is not a proposition.
A. All real numbers are positive.
B. $x + y = 2$
C. All cows eat grass.

Answer: ___

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2. **(2 points)** `Library/Westmont/EoDM3/Exercises_1_1/exer1_1_5.pg`

Let s be the following statement.
If it is raining, then the ground is wet.

Which is the converse of s?

- ?
- If it is not raining, then the ground is not wet.
- If it is raining, then the ground is not wet.
- If the ground is wet, then it is raining.
- If the ground is not wet, then it is raining.
- If the ground is not wet, then it is not raining.

Which is the contrapositive of s?

- ?
- If it is not raining, then the ground is not wet.
- If it is raining, then the ground is not wet.
- If the ground is wet, then it is raining.
- If the ground is not wet, then it is raining.
- If the ground is not wet, then it is not raining.

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3. **(5 points)** `Library/MontanaState/Misc.Logic/1.4A1Logic1.pg`

True or False?
If a conditional sentence is true, its converse is false.

- A. True
- B. False

True or False?
If a conditional sentence is true, its contrapositive is true.

- A. True
- B. False

True or False?
If a conditional sentence is false, its converse is false.

- A. True
- B. False

True or False?
The contrapositive of the contrapositive of a conditional is the original conditional.

- A. True
- B. False

True or False?
The converse of the converse of a conditional is the original conditional.

- A. True
- B. False

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4. **(2 points)** `Library/Westmont/EoDM3/Inquiry_1_1/iprob1_2.pg`

Buttercup knows whether or not Westley is lying. She promises that if Westley is lying, she will give you a cookie. Buttercup always keeps her promises.

Suppose she does not give you a cookie; what can you conclude?

- ?
- Westley is lying.
- Westley is not lying.
- Not enough information to determine.

Suppose she gives you a cookie; what can you conclude?

- ?
- Westley is lying.
- Westley is not lying.
- Not enough information to determine.

5. **(2 points)** `Library/SDSU/Discrete/Logic/formallogicB7.pg`
Convert the following statement using an "if-then" structure.

John doesn't own a dog, or he owns a cat.

Choose the correct statement:

- A. If John doesn't own a dog, then he owns a cat
- B. If John doesn't own a cat, then he owns a dog
- C. If John owns a dog, then he owns a cat
- D. If John owns a cat, then he owns a dog

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6. **(6 points)** `Library/SUNYSB/necsuff.pg`

Which proposition is a necessary condition for the following statement to be true: "I don't go to Paris and I visit the Eiffel Tower."

- A. I visit the Eiffel Tower
- B. I do not visit the Eiffel Tower.
- C. I go to Paris and I visit the Eiffel Tower.
- D. I go to Paris if and only if I visit the Eiffel Tower.
- E. I go to Paris

Which proposition is a necessary condition for the following statement to be true: "P is a square and P is not a rectangle."

- A. P is a square
- B. P is a square and P is a rectangle.
- C. P is not a square
- D. P is a square if and only if P is a rectangle.
- E. P is a rectangle

Which proposition is a sufficient condition for the following statement to be true: "If n is prime then n is odd or n is 2."

- A. n is prime and n is even but not 2.
- B. n is prime
- C. n is composite
- D. n is even but not 2
- E. n is prime or n is odd or n is 2.
- F. If n is odd or n is 2 then n is prime.
- G. n is composite or n is even but not 2.

Rewrite the following as an equivalent if then statement: "'r is rational' is a necessary condition for 'the decimal expansion of r is repeating'."

- A. If r is irrational then the decimal expansion of r is repeating.
- B. If r is rational then the decimal expansion of r does not repeat.
- C. If the decimal expansion of r does not repeat then r is irrational.
- D. If r is rational then the decimal expansion of r is repeating.
- E. If the decimal expansion of r is repeating then r is irrational.
- F. If the decimal expansion of r does not repeat then r is rational.
- G. If the decimal expansion of r is repeating then r is rational.
- H. If r is irrational then the decimal expansion of r does not repeat.

Rewrite the following as an equivalent if then statement: "'it is a right triangle' is a necessary condition for 'this triangle has two 45 degree angles'."

- A. If this triangle has two 45 degree angles then it is not a right triangle.
- B. If it is a right triangle then this triangle does not have two 45 degree angles.
- C. If this triangle has two 45 degree angles then it is a right triangle.
- D. If it is not a right triangle then this triangle has two 45 degree angles.
- E. If this triangle does not have two 45 degree angles then it is not a right triangle.
- F. If this triangle does not have two 45 degree angles then it is a right triangle.
- G. If it is a right triangle then this triangle has two 45 degree angles.
- H. If it is not a right triangle then this triangle does not have two 45 degree angles.

Rewrite the following as an equivalent if then statement: "'I feel enfranchised' is a sufficient condition for 'I vote in the election'."

- A. If I don't vote then I feel disenfranchised.
- B. If I feel disenfranchised then I don't vote.
- C. If I vote in the election then I feel enfranchised.
- D. If I don't vote then I feel enfranchised.
- E. If I feel enfranchised then I vote in the election.
- F. If I feel enfranchised then I don't vote.
- G. If I vote in the election then I feel disenfranchised.
- H. If I feel disenfranchised then I vote in the election.

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8. **(7 points)** `Library/SUNYSB/implication.pg`

What is the negation of the following: "If I go to Paris then I visit the Eiffel Tower."

- A. I go to Paris or I don't visit the Eiffel Tower.
- B. If I don't go to Paris then I visit the Eiffel Tower.
- C. I go to Paris and I don't visit the Eiffel Tower.
- D. I don't go to Paris or I visit the Eiffel Tower.
- E. If I visit the Eiffel Tower then I go to Paris.
- F. I go to Paris and I visit the Eiffel Tower.
- G. If I go to Paris then I visit the Eiffel Tower.
- H. I don't go to Paris and I don't visit the Eiffel Tower.
- I. If I don't go to Paris then I don't visit the Eiffel Tower.
- J. I go to Paris or I visit the Eiffel Tower.
- K. If I don't visit the Eiffel Tower then I don't go to Paris.

What is the negation of the following: ”If P is a square then P is a rectangle.”

- A. If P is a square then P is a rectangle.
- B. P is not a square and P is a rectangle.
- C. If P is not a rectangle then P is not a square.
- D. P is a square and P is a rectangle.
- E. If P is a rectangle then P is a square.
- F. P is a square or P is not a rectangle.
- G. P is a square or P is a rectangle.
- H. P is not a square or P is a rectangle.
- I. If P is not a square then P is not a rectangle.
- J. P is a square and P is not a rectangle.
- K. If P is not a square then P is a rectangle.

What is the negation of the following statement: ”n is prime and n is odd or n is 2.”

- A. n is prime or n is odd or n is 2.
- B. n is prime or n is even but not 2.
- C. n is composite or n is odd or n is 2.
- D. n is prime and n is even but not 2.
- E. n is composite or n is even but not 2.
- F. n is composite and n is odd or n is 2.
- G. n is composite and n is even but not 2.
- H. n is prime and n is odd or n is 2.

What is the negation of the following statement: ”this triangle has two 45 degree angles or it is a right triangle.”

- A. this triangle does not have two 45 degree angles and it is not a right triangle.
- B. this triangle has two 45 degree angles and it is not a right triangle.
- C. this triangle has two 45 degree angles or it is not a right triangle.
- D. this triangle has two 45 degree angles and it is a right triangle.
- E. this triangle does not have two 45 degree angles or it is a right triangle.
- F. this triangle does not have two 45 degree angles and it is a right triangle.
- G. this triangle does not have two 45 degree angles or it is not a right triangle.
- H. this triangle has two 45 degree angles or it is a right triangle.

What is the converse of the following: ”If I am hungry then I eat an apple.”

- A. If I am hungry then I eat an apple.
- B. If I eat an apple then I am not hungry.
- C. If I’m not hungry then I don’t eat an apple.
- D. If I’m hungry then I eat an apple.
- E. If I eat an apple then I am hungry.
- F. If I don’t eat an apple then I’m not hungry.

What is the inverse of the following: ”If P is a square then P is a rectangle.”

- A. If P is a rectangle then P is a square.
- B. If P is a square then P is not a rectangle.
- C. If P is not a square then P is not a rectangle.
- D. If P is not a rectangle then P is not a square.
- E. If P is a rectangle then P is not a square.
- F. If P is a square then P is a rectangle.

What is the contrapositive of the following: ”If I am hungry then I eat an apple.”

- A. If I’m hungry then I don’t eat an apple.
- B. If I eat an apple then I am hungry.
- C. If I’m hungry then I eat an apple.
- D. If I don’t eat an apple then I’m not hungry.
- E. If I am hungry then I eat an apple.
- F. If I don’t eat an apple then I’m hungry.

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9. **(7 points)** `Library/Utah/Calculus_I/set1_Preliminaries/1210s1p27.pg`

The next few problems are simple exercises in logic. Section 1.1 of the textbook discusses the concept of the *converse* , the *contrapositive,* and the *negation* of a statement. For example, consider the statement *all natural numbers are real numbers.* (This is a true statement, but this is actually not important for this discussion.) This statement can be put as an implication: *if x is a natural number, then x is a real number.* The **converse** of this statement is *all real numbers are natural numbers* , or *if x is a real number then it is a natural number* , (which is a false statement), the **contrapositive** is *if x is not a real number then it isn’t a natural number* (which is a true statement), and the **negation** of the statement is *some natural numbers are not real numbers* (which is a false statement).

The purpose this particular problem is to illustrate the pattern of the next couple of problems. You already know the answers, so it is just a matter of entering them. In this problem, WeBWorK will tell you separately for each answer whether it is correct or not, but in the next two you will have to enter everything correctly to get credit.

Let S be the statement: *All natural numbers are real numbers.*

Complete the sentences below, filling in A-G from the following list, and T or F for true or false, as appropriate.

A. Numbers aren’t natural.

B. All real numbers are natural.

C. Some natural numbers aren’t real numbers.

D. Some real numbers aren’t natural numbers.

E. No real number is natural.

F. A number can't be natural if it isn't real.

G. A number can't be real if it isn't natural.

S is ___ (true or false).

The converse of S is ___ (enter a letter from A-G) and that statement is ___.
The contrapositive of S is ___ and that statement is ___.
The negation of S is ___ and that statement is ___ (true or false).

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10. **(7 points)** `Library/Utah/Calculus_I/set1_Preliminaries/1210s1p28.pg`
Let S be the statement: *All men are humans.*

Complete the sentences below, filling in A-G from the following list, and T or F for true or false, as appropriate.

A. Some men aren't humans.

B. Some men are humans.

C. Some humans aren't men.

D. No men are humans.

E. If you aren't a human you aren't a man.

F. Women aren't human.

G. All humans are men.

S is ___ (true or false).

The converse of S is ___ (enter a letter from A-G) and that statement is ___ (true or false).
The contrapositive of S is ___ and that statement is ___.
The negation of S is ___ and that statement is ___.

There are two versions of this problem with the roles of "men" versus "women" randomly interchanged.

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11. **(7 points)** `Library/Utah/Calculus_I/set1_Preliminaries/1210s1p29.pg`
Let the following statement:

$$\text{For any } x, \text{ if } \quad x > 0 \quad \text{then} \quad x^3 > 0.$$

Complete the sentences below, filling in A-G from the following list.

A. Real numbers are all zero.

B. For any x, if $x^3 > 0$, then $x > 0$.

C. There is some $x > 0$ such that $x^3 \leq 0$

D. For any x, if $x \geq 0$ then $x^3 \leq 0$.

E. For any x, if $x > 0$ then $x^3 > x$.

F. For any x, $x^3 > x$.

G. For any x, if $x^3 \leq 0$ then $x \leq 0$.

S is $\boxed{?}$

The converse of S is ___ (enter a letter from A-G) and that statement is $\boxed{?}$.
The contrapositive of S is ___ and that statement is $\boxed{?}$.
The negation of S is ___ and that statement is $\boxed{?}$.

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12. **(10 points)** `Library/SDSU/Discrete/Logic/ttlogicequivA7.pg`
Complete the truth table for the following statement:

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

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