

Math 112 - Test 2

October 13, 2016

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (5 points) Which of these sentences are statements? Circle all that apply.
 - (a) Bill Gates is the founder of Microsoft.
 - (b) Who will be elected president?
 - (c) $12 + 8 = 13$
 - (d) Leonard Euler was born in 1707.
 - (e) Be cool!

2. (5 points) Identify each as a conjunction, disjunction, conditional, or biconditional.
 - (a) All dogs are mammals.

 - (b) Sara and Brian went hiking in the mountains.

 - (c) I'm going to pass my math class if and only if I do my homework.

 - (d) When your battery dies, you should charge your phone.

 - (e) Either he makes the shot, or he loses the game.

3. (3 points) Explain why the sentence "This statement is false" is not a statement.

4. (6 points) Write the negation of each statement in a correct sentence.
- (a) Steve likes to drink iced tea.
 - (b) Everyone in the class was bored by the professor's lecture.
 - (c) Some people watch *Game of Thrones*.
5. (6 points) Let $p =$ "The dog is a poodle" and let $q =$ "The dog bites." Write each statement in words.
- (a) $q \longrightarrow \sim p$
 - (b) $\sim(q \wedge p)$
 - (c) $p \longrightarrow (p \vee q)$
6. (6 points) Refer to the statements p and q from the problem directly above. Write each statement in symbolic form.
- (a) The dog bites, but it is not a poodle.
 - (b) The dog bites if it is a poodle.
 - (c) The dog bites if and only if it is not a poodle.

7. (6 points) Construct the truth table for $(\sim q \wedge p) \longrightarrow \sim p$.

8. (2 points) If p is false, what is the truth value of $\sim(\sim(\sim p))$?

9. (4 points) Suppose that the following conditional statement is true:

If Sarah gets a good lawyer, then she will not go to jail.

What valid conclusion can we reach if Sarah goes to jail? Use a common form of argument to briefly explain how you know your conclusion is valid.

10. (5 points) Consider the following conditional statement:

If Sam takes his medicine, then he will get well.

(a) State the inverse.

(b) State the contrapositive.

(c) State the converse.

(d) Of the three, which is equivalent to the original statement?

Inverse

Contrapositive

Converse

11. (2 points) When is the implication $p \longleftrightarrow q$ false?

12. (6 points) Use truth tables to show that the statements $p \longrightarrow q$ is logically equivalent to $\sim p \vee q$.

13. (4 points) Use DeMorgan's Laws to write a logically equivalent statement.

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

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

14. (4 points) Write the negation of the statement "The coffee is a latte or an espresso."

15. (6 points) Use Euler circles to determine the validity of the following argument.

$$\begin{array}{l} p \longrightarrow q \\ q \longrightarrow r \\ \hline \therefore p \longrightarrow r \end{array}$$

16. (9 points) Consider the following argument in symbolic form.

$$\frac{p \vee q}{\sim p} \therefore q$$

(a) Use the truth table method to determine the validity of the argument.

(b) Is the argument a common form? If so, use your knowledge of common forms to explain the validity.

17. (5 points) Give a symbolic example of a common-form argument that is invalid. Explain how you know it is invalid.

18. (8 points) Write the argument in symbolic form. Then use a common-form argument to determine its validity. Explain your reasoning.

Premise 1: George will pass the class if he gets an A on the last test.

Premise 2: If George gets an A on the last test, then he will not have to pay for the class.

Conclusion: If George will pass the class, then George will not have to pay for the class.

19. (8 points) Consider the argument shown below.

Premise 1: Some dogs bite.

Premise 2: All poodles are dogs.

Conclusion: Some poodles bite.

(a) Sketch an Euler circle diagram that shows the argument is invalid.

(b) Even though the argument is invalid, some Euler circle diagrams satisfy the two premises and the conclusion. Draw such a diagram.