

Quiz Policy

Always explain your answers. A turn in later than 11:59 pm on the due date will receive a grade of zero. Quiz solutions not your own and obtained from other students or any other sources is considered a violation of academic integrity. Ask the Instructor if you have academic integrity concerns about the solutions you are turning in.

CS 2200
Quiz 02
Fall 2023

Points: 10 points

Reference: Epp5 Sections 2.2, 2.3, 2.4, 3.1, 6.1

In 1) Rewrite each statement without using quantifiers or variables. Indicate which are true and which are false, and justify your answers as best as you can.

1) Let the domain of x be the set of geometric figures in the plane, and let $\text{Square}(x)$ be “ x is a square” and $\text{Rect}(x)$ be “ x is a rectangle.”

- I. $\exists x$ such that $\text{Rect}(x) \wedge \text{Square}(x)$
- II. $\exists x$ such that $\text{Rect}(x) \wedge \sim \text{Square}(x)$
- III. $\forall x, \text{Square}(x) \rightarrow \text{Rect}(x)$

- 2) Determine whether the following argument is valid or invalid. Include a truth table and a few words explaining why the truth table shows validity or invalidity.

If 12 divides 709,438 then 3 divides 709,438.

If the sum of the digits of 709,438 is divisible by 9 then 3 divides 709,438.

The sum of the digits of 709,438 is not divisible by 9.

Therefore, 12 does not divide 709,438.

- 3) Write the form of the following argument. Is the argument valid or invalid? Justify your answer.

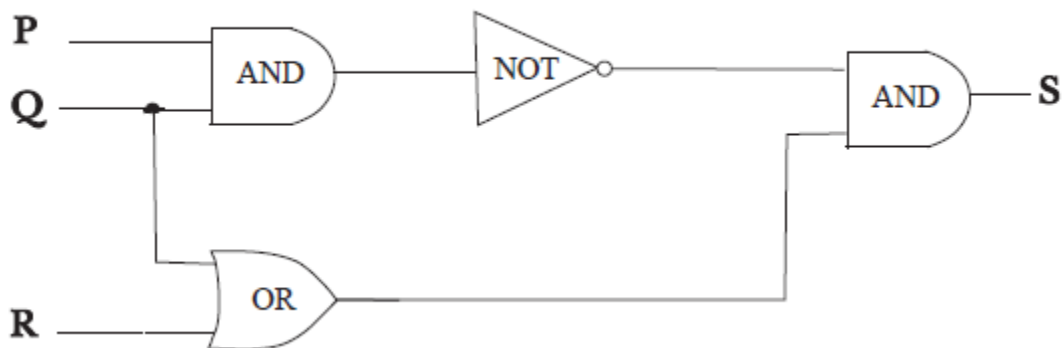
If 54,587 is a prime number, then 17 is not a divisor of 54,587.

17 is a divisor of 54,587.

Therefore, 54,587 is not a prime number.

4)

Consider the following circuit.



- I. Find the output **S** of the circuit corresponding to the input **P** = 1, **Q** = 0, and **R** = 1.
- II. Write the Boolean expression corresponding to the circuit.

5) Consider the statement “The square of any odd integer is odd.”

- I. Rewrite the statement in the form \forall ____ n , _____. (Do not use the words “if” or “then.”)
- II. Rewrite the statement in the form \forall ____ n , if _____ then _____. (Make sure you use the variable n when you fill in each of the second two blanks.)
- III. Write a negation for the statement.

6) Rewrite the following statement formally. Use variables and include both quantifiers \forall and \exists in your answer.

Every rational number can be written as a ratio of some two integers.

7) Design a circuit to take input signals **P**, **Q** and **R** and output a 1 if, and only if, all three of **P**, **Q** and **R** have the same value.

8) Let $A = \{x \in \mathbf{Z} \mid x = 6a + 4 \text{ for some integer } a\}$,
 $B = \{y \in \mathbf{Z} \mid y = 18b + 2 \text{ for some integer } b\}$, and
 $C = \{z \in \mathbf{Z} \mid z = 18c + 16 \text{ for some integer } c\}$

Prove or disprove each of the following statements :

a. $A \subseteq B$

b. $B \subseteq A$

c. $B = C$