

CSE 2500-01: Homework 4

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Coded in L^AT_EX

Problems

Question 1.

Let $B(x)$ be “ $-10 < x < 10$.” Find the truth set of $B(x)$ for each of the following domains:

(a) \mathbb{Z}

$$\{-9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

(b) \mathbb{Z}^+

$$\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

(c) The set of all even integers

$$\{-8, -6, -4, -2, 0, 2, 4, 6, 8\}$$

Question 2.

Rewrite each of the following statements in the form “ $\forall x$, if ___ then ___”.

(a) All Python programs have at least 5 lines.

$\forall x$, if x is a Python program, then x has at least 5 lines.

(b) Any valid argument with true premises has a true conclusion.

$\forall x$, if x is a valid argument with true premises, then x has a true conclusion.

Question 3.

Rewrite the following statement in two forms:

(a) “ $\exists x$ such that ___”

(b) “ $\exists x$ such that ___ and ___”

where the statement is “Some questions are easy.”

(a) \exists a question x such that x is easy.

(b) $\exists x$ such that x is a question and x is easy.

Question 4.

Write a negation for each statement:

(a) \forall real number x , if $x^2 \geq 1$ then $x > 0$.

\exists a real number x such that $x^2 \geq 1$ and $x \not> 0$.

(b) $\forall n \in \mathbb{Z}$, if n is prime then n is odd or $n = 2$.

$\exists n \in \mathbb{Z}$, such that if n is prime and is not odd and $n \neq 2$.

Question 5.

Rewrite each statement in if-then form:

- (a) Being divisible by 8 is a sufficient condition for being divisible by 4.

If an integer is divisible by 8, then it is divisible by 4.

- (b) Passing a comprehensive exam is a necessary condition for obtaining a master's degree.

If a person obtains a master's degree, then that person has passed a comprehensive exam.

- (c) A polygon is square only if it has four sides.

If a polygon is a square, then it has four sides.

Question 6.

The following statements refer to Tarski's world (Figure 1).

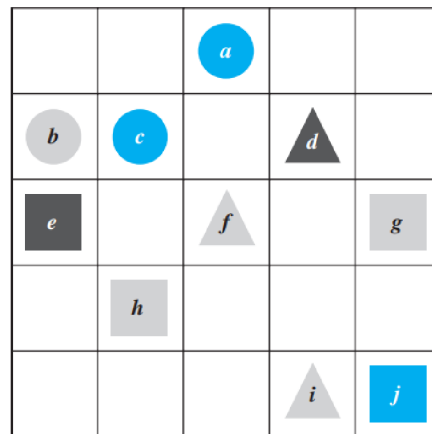


Figure 1: Tarski's World Diagram

For each:

- (a) Determine whether the statement is true or false and justify your answer.

- (b) Write a negation for the statement.

1. \forall circle x and \forall square y , x is above y .

- (a) This statement claims that all of the circles happen to be above squares. This is true. The circles are b, c , and a and the squares are e, g , and j . All of b, c, a lie above e, g, j .

- (b) There is a circle, x and square y such that x is not above y

2. \exists a circle x and \exists a square y such that x is above y and x and y have the same color.
- (a) This statement claims that there are a circle and square such that the circle is above the square and has the same color as the square. This is true. For example, the circle c lies above the square, j and is the same color: blue.
 - (b) \forall circle x and \forall square y , x is not above y or x and y do not have the same color.