Take Test: Quiz 5a: Predicate Logic – Part1

Instructions	**This quiz uses special symbols that may not display properly for you! If that happens, use the reference version of the quiz in the "Reference Versions of Online Quizzes" folder.** Focuses on Epp (4th ed), sections 3.1 and 3.3 (skipping "Negation" in 3.3). You may also want to reread Chapter 2. (See the "Textbook and References" section of the website for textbook sections.) These quizzes are open book. This first part is marked for completeness and correctness and to be completed individually with no assistance from anyone. You must submit your quiz by its deadline (5PM on the due date). Only attempts submitted by that time will be marked. **It is your responsibility to submit the quiz by the listed time. You may submit multiple times. Your quiz score will be the largest score of your attempts.**
Multiple Attempts	This test allows multiple attempts.
Force Completion	This test can be saved and resumed later.

Save All Answers | Close Window | Save and Submit

10 points Saved

Question 1

Which of the quantified statements below is equivalent to the following statement?

It is not the case that all animals like honey.

Take D to be the domain of all *animals*
Honey(x) is the predicate statement 'x likes honey'
Reminder on notation (negations and quantifiers): ~∃x ∈ D, P(x) is the same as ~(∃x ∈ D, P(x)).

(Whereas the text (~∃x ∈ D), P(x) is not a meaningful or legal logical statement.)

- ○ 1. ∀x ∈ D, ~Honey(x)
- ○ 2. ~∀x ∈ D, ~Honey(x)
- ◉ 3. ~∀x ∈ D, Honey(x)
- ○ 4. ~∃x ∈ D, ~Honey(x)

10 points Saved

Question 2

Which of the quantified statements below is equivalent to the following statement?

There is a bear that does not like honey.

Take D to be the domain of all *animals*
Honey(x) is the predicate statement 'x likes honey'
Bear(x) is the predicate statement 'x is a bear'

Hint: translate the quantifier(s) separately from the rest of the statement. First, pick the quantifier. Then, change the statement so it's about particular value(s) and you can translate it like you did propositional logic statements.

For example, think about this statement but only with reference to Pooh: "Pooh is a bear that does not like honey." Translate that to propositional logic and then replace Pooh with a variable and include the appropriate quantifier.
Once you put in specific values (like Pooh), a predicate logic statement might as well be a propositional logic statement instead, and you already know what you're doing with propositional logic!

- ○ 1. $\forall x \in D$, Bear(x) ^ ~Honey(x)
- ◉ 2. $\exists x \in D$, Bear(x) ^ ~Honey(x)
- ○ 3. $\exists x \in D$, Bear(x) ^ Honey(x)
- ○ 4. $\exists x \in D$, Bear(x) → ~Honey(x)
- ○ 5. $\exists x \in D$, Bear(x) ∨ Honey(x)

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Question 3

Which of the informal statements below is equivalent to the following quantified statement?

$\forall x \in P$, Shadow(x) ^ Ladder(x)

P – the domain of people
Shadow(x) – the predicate statement "x is afraid of his/her shadow"
Ladder(x) – the predicate statement "x is afraid to walk under ladders"
Hint: translate the quantifier(s) separately from the rest of the statement. First, pick the quantifier. Then, change the statement so it's about particular value(s) and you can translate it like you did propositional logic statements.

- ◉ 1. Everyone is afraid of their shadows and is afraid of walking under ladders.
- ○ 2. Everyone is either afraid of their shadows or is afraid of walking under ladders.
- ○ 3. Everyone is afraid of their shadows.
- ○ 4. People who are afraid of walking under ladders are also afraid of their shadows

10 points Saved

Question 4

Which of the informal statements below is equivalent to the following quantified statement?

$\exists x \in D, \text{Sunny}(x) \wedge \text{Rainy}(x)$

Take D to be the domain of integers from 1 to 31
Sunny(x) to be the predicate statement "The xth of December 1847 was a sunny day"
Rainy(x) to be the predicate statement "The xth of December 1847 was a rainy day"

- ○ 1. Every day in December 1847 was sunny or rainy.
- ◉ 2. There was a day in December 1847 that was both sunny and rainy.
- ○ 3. Every day in December 1847 was both sunny and rainy
- ○ 4. A day in December 1847 could not have been both sunny and rainy.

10 points Saved

Question 5

Which of the statements below is equivalent to the following quantified statement?

$\forall x \in D, \exists y \in D, \text{Prime}(y) \wedge x \neq y$

Let D be the set of positive integers and Prime(z) be the predicate statement "z is a prime number".
Reminder: "prime" means "having only itself and 1 as factors". For example, 2, 3, and 5 are the first three primes.

- ○ 1. For every positive integer x, every prime number y isn't equal to x
- ◉ 2. For every positive integer x, there is some prime y that isn't equal to x.
- ○ 3. There is some positive integer x such that $x \neq y$ for all primes y.
- ○ 4. There is some integer x and some prime y such that x isn't equal to y.

10 points Saved

Question 6

What can you say about the truth value of the following statement?
$\forall x \in D, \text{Even}(x)$

Even(x) means "x is an even number"

- ◉ 1. True for D = the collection of the integers 2, 4, 6, 8
- ○ 2. True for D = the collection of all integers
- ○ 3. False for D = the collection of the integers 2, 4, 6, 8
- ○ 4. False for any choice of D

10 points Saved

Question 7

What can you say about the truth value of the following statement?

$\exists x \in D. \exists v \in D. \exists z \in D. x^2 + v^2 = z^2$

Let D be the domain of all positive integers.

Hint: Pay attention to the type of quantifier you're dealing with!

1. False, because x = 1, y = 1, z = 2 make the predicate false
2. False, because no x, y, z in the domain can satisfy the above condition
3. True, because every value of x, y, z in the domain satisfies the above condition
4. True, because x = 3, y = 4, z = 5 satisfy the above condition

10 points Saved

Question 8

What can you say about the truth value of the following statement?

$\forall x \in D$, Prime(x) $\vee$ Even(x)

Take D to be the collection of all positive integers.
Prime(x) means "x is a prime number"
Even(x) means "x is an even number"
Reminder: "prime" means "having only itself and 1 as factors". For example, 2, 3, and 5 are the first three primes.

Hint: Pay attention to the type of quantifier and the logic operator you're dealing with!

1. This statement is true
2. This statement is false, as shown by the example x = 2.
3. This statement is false, as shown by the example x = 7
4. This statement is false, as shown by the example x = 11
5. This statement is false, as shown by the example x = 9
6. This statement is false, but not for any of the examples given here

10 points Saved

Question 9

Let P(x) be the predicate statement "x went to the party".
Use the following notation for this problem:
G – George
H – Henry
I – Isabelle
J – Jenna
K – Kyle

Suppose that we know George, Henry, and Jenna went to the party, but Isabelle and Kyle didn't. What can we say about the truth value of the following quantified statement?

$\exists x \in D$, ~P(x)

Question Completion Status:

2. False, because P(x) is true for all x in the domain D

3. True, because P(G) is true

4. True, because P(I) is false

10 points Saved

Question 10

Let D be the domain of 8-bit signed binary numbers, *not* mathematical integers.
Is the following statement true?

$\forall x \in D, \forall y \in D, ((x > 0) \wedge (y > 0)) \rightarrow (x + y) > 0$

Hint: bear in mind that the + here is addition over 8-bit signed binary numbers (clock arithmetic), NOT standard mathematical addition.

1. Definitely true.
2. Definitely false.
3. As is, can't tell, but I could tell with further information.
4. It's impossible to tell.
5. The statement is ill-formed.

10 points Saved

Question 11

Let Perfect(x) be the predicate statement "x is a perfect square", where x is in the domain positive integers.
(A perfect square is a number that has an integer square root; i.e. $25 = 5^2$, so 25 is a perfect square)

Which pair of truth values/predicate evaluations below is matched properly?

1. Perfect(10) – True
2. Perfect(9) – False
3. Perfect(16) – True
4. Perfect(1.5) – True

10 points Saved

Question 12

Let Prime(x) mean "x is prime" and let Odd(x) mean "x is odd", where x is in both cases in the domain positive integers.

What is the truth value of the following statement: **Prime(10) → Odd(2)**
Hint: remember that → does *not* always correspond to our English language notion of "if/then" – apply the formal definition.

- True
- False

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Question 13

I completed this part of the quiz with no help from anyone, except possibly the course staff (as described in the academic conduct policy and the instructions for this quiz).

- (•) True
- ( ) False

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