

Preliminaries Quiz

Due Sep 12 at 9:30am**Points** 62**Questions** 9**Available** Sep 12 at 9:05am - Sep 12 at 9:30am 25 minutes**Time Limit** 20 Minutes

Instructions

Read the directions of each question carefully, and work quickly so that you get to all of the questions. (You can always make a second pass if you finish early.)

This quiz was locked Sep 12 at 9:30am.

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	20 minutes	50.73 out of 62

❗ Correct answers are hidden.

Score for this quiz: **50.73** out of 62

Submitted Sep 12 at 9:25am

This attempt took 20 minutes.

Question 1

6 / 6 pts

For each of the following English sentences in the first column of the table below, choose the correct translation from the dropdown in the second column. Assume a universe of discourse consisting of students, including the specific students john, paul, ringo, and george, and the predicates $\text{man}(x)$, $\text{woman}(x)$, $\text{knows}(x, y)$, and $\text{studies}(x)$, which stand for “x is a man”, “x is a woman”, “x knows y”, and “x studies”, respectively.

John knows a woman.	$\text{exists } x, \text{woman}(x) \wedge \text{knows}(\text{john}, x)$
No woman who studies knows Ringo.	$\text{not } (\text{exists } x, \text{woman}(x) \wedge \text{studies}(x) \wedge \text{knows}(x, \text{ringo}))$

A man who knows John knows everyone who studies.

exists x , $\text{man}(x) \wedge \text{knows}(x, \text{john}) \wedge$
forall y , $\text{studies}(y) \rightarrow \text{knows}(x, y)$

Answer 1:

exists x , $\text{woman}(x) \wedge \text{knows}(\text{john}, x)$

Answer 2:

not (exists x , $\text{woman}(x) \wedge \text{studies}(x) \wedge \text{knows}(x, \text{ringo})$)

Answer 3:

exists x , $\text{man}(x) \wedge \text{knows}(x, \text{john}) \wedge$ forall y , $\text{studies}(y) \rightarrow \text{knows}(x, y)$

Partial

Question 2

6.4 / 8 pts

Suppose that the universe of discourse is the set of natural numbers $\mathbf{N} = \{0, 1, 2, \dots\}$. Which are of the following quantified statements is true? (Select all that apply.)

☒ forall x , forall y , $xy = yx$

☐ forall x , forall y , forall z , $x < y \vee y < z \vee z < x$

☒ exists x , exists y , $x > y \wedge xy = 3$

☐ forall x , exists y , $x > y$

☒ exists x , forall y , $x \leq y$

☒ forall x , exists y , $x = 2y \vee x = 2y + 1$

☐ forall x , exists y , $x < y$

☐ exists x , forall y , $x \geq y$

Partial

Question 3

4 / 5 pts

Suppose that the sets A, B, and C are as follows:

$$A = \{1,4,5\} \quad B = \{3,4\} \quad C = \{3,5,6\}$$

Match the set operations on the left with their results on the right

A intersect B

{4}



B union C

{3,4,5,6}



C - B

{5,6}



B x B

{(3,3), (3,4), (4,3), (4,4)}



Powerset(B)

{ {}, 3, 4, {3,4} }



Partial

Question 4

8 / 10 pts

Which of the following statements are true for arbitrary sets A, B, and C?
(Select all that apply.)

☒ A intersect A = A

☐ A - A = A

☒ (A - B) intersect (B - A) = {}

☐ A union (B intersect C) = (A union B) intersect C

- ☐ B subset (A - B)
- ☒ (A - B) union (B - A) = A union B
- ☐ B subset (A intersect B)
- ☒ (A intersect B) subset B
- ☒ A union A = A
- ☒ A subset (A union B)

Partial

Question 511 / 12 pts

For each of the four **relations** between natural numbers x and y in the left column of the table below, and each of the three **properties** of relations in the top row, indicate whether the given **relation** has the given **property** by writing a lowercase "y" or "n" (for "yes" or "no") in each cell.

$\{(x,y) \mid x \leq N, y \leq N, \text{relation}\}$	reflexive	symmetric	transitive
$x \neq y$	n	y	n
$x \geq y$	y	n	y
$x + y \geq 10$	n	y	n
even ($x + y$)	y	y	n

Answer 1:

n

Answer 2:

y

Answer 3:

n

Answer 4:

y

Answer 5:

n

Answer 6:

y

Answer 7:

n

Answer 8:

y

Answer 9:

n

Answer 10:

y

Answer 11:

y

Answer 12:

n

Partial**Question 6****3.33 / 5 pts**

Which of the following are equivalence relations on the set $A = \{1,2,3\}$?
(Select all that apply.)

☐ $\{(1,2), (2,1), (1,1), (2,2)\}$
☒ $A \times A$
☐ $\{(1,2), (2,3), (3,1), (1,3), (3,2), (2,1)\}$
☐ $\{(2,3), (1,1), (3,2), (3,3), (2,2)\}$
☒ $\{(1,1), (2,2), (3,3)\}$

Question 7

8 / 8 pts

Which of the following are partitions of the set $A = \{1,2,3,4,5,6,7\}$? (Select all that apply.)

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

Partial

Question 8

1 / 4 pts

Consider the function $f : \mathbf{N} \rightarrow \mathbf{N}$ on the natural numbers given by $f(x) = x / 3$, where $'/'$ is integer division (i.e., `/` on `int` in C/C++ or ``div`` in Haskell), and the relation R on \mathbf{N} defined by

$$R = \{ (x,y) \mid f(x) = f(y) \}$$

In other words, R is the kernel of f . For each natural number n on the left below, select the correct value of $[n]_R$ from the right.

2

{0,1,2}



4

{1,2,3}



6

{3,4,5}



8

{5,6,7}



Partial

Question 9

3 / 4 pts

Consider again the function $f : \mathbf{N} \rightarrow \mathbf{N}$ and relation R from the previous question and define

$$P = \{ [a]_R \mid a \in \mathbf{N} \}$$

Which of the following statements are true about f , R , and P ? (Select all that apply.)

☒ R is an equivalence relation

☒ P is a partition

☒ R is the kernel of f

☐ f is a quotient

Quiz Score: **50.73** out of 62