

1

$C(x)$: has a **cat** · $F(x)$: has a **ferret** · $D(x)$ has a **dog**
 $B(x)$: **bikes** to campus · $H(x)$: wears a **helmet**
 $R(x)$: ate **breakfast** today · $L(x)$: **lives on campus**

name	C	F	D	B	H	R	L
Alex	✓			✓	✓	✓	
Bea	✓	✓		✓	✓	✓	✓
Chen			✓			✓	
Devo				✓	✓		✓
Emi	✓		✓			✓	
Farah		✓				✓	✓
Gus			✓				
Hana	✓						✓

For each of the following questions: 1) write an equivalent English statement, 2) determine its truth value, 3) write its negation.

1. $\exists x, C(x) \wedge F(x) \wedge \neg D(x)$

2. $\forall x, B(x) \rightarrow H(x)$

3. $\forall x, C(x) \wedge \neg D(x)$

4. $\forall x, R(x) \vee L(x)$

5. $\exists x, \neg(C(x) \vee F(x))$

2

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Bea	✓	✓		✓	✓	✓	✓
Chen			✓			✓	
Devo				✓	✓		✓
Emi	✓		✓			✓	
Farah		✓				✓	✓
Gus			✓				
Hana	✓						✓

Your turn: write one true and one false statement containing at least two predicates, and the negation of each.

1. True statement:

Negation:

2. False statement:

Negation:

3

In the grids below, each row represents a Hero (H) and each column represents a Villain (V). A heart in cell (x,y) means Hero x likes Villain y .

- Using as few as possible, place hearts in the grid to represent $\forall x, \exists y, x \text{ likes } y$

- Using as few as possible, place hearts in the grid to represent $\exists y, \forall x, x \text{ likes } y$

♥				
	♥			
			♥	
	♥			

Determine whether each of the following statements are true or false for the grid above.

- $\exists y, \forall x, x \text{ likes } y$
- $\forall x, \exists y, x \text{ likes } y$
- $\exists x, \forall y, x \text{ likes } y$
- $\forall y, \exists x, x \text{ likes } y$

4 Suppose we create a new quantifier, $\exists^2$ which means “there exists exactly 2.” In each of the Hero/Villain puzzles below, determine the minimum and the maximum number of hearts you should place in order to make each quantified statement true.

1. $\forall x, \exists^2 y, x \text{ likes } y$

Min: _____

Max: _____

2. $\exists^2 y, \forall x, x \text{ likes } y$

Min: _____

Max: _____