CSE 280 Challenge Set 02

Question 1

Part 1

The NAND operator $\uparrow$ is defined by the following truth table. Use truth tables to show that $p \uparrow q$ is logically equivalent to $\neg(p \wedge q)$.

p	q	$p \uparrow q$
T	T	F
T	F	T
F	T	T
F	F	T

Part 2

Use the result from Part 1 to simplify: $(p \uparrow p) \uparrow (q \uparrow q)$.

Question 2

The domain of the following predicates is the set of all plants.

$P(x) =$ "x is poisonous."

$Q(x) =$ "Jeff has eaten x."

Translate the following statements into predicate logic:

- Some plants are poisonous.
- Jeff has never eaten any poisonous plant.
- There are some non-poisonous plants that Jeff has not eaten.
- All plants are poisonous and Jeff hasn't eaten any of them

Question 3

In the domain of all nonzero integers, let $I(x, y)$ be the predicate "x/y is an integer." Determine whether the following statements are true or false, and explain why. Hint: Find values of x and y for which $I(x, y)$ is true.

- $(\forall y)(\exists x)I(x, y)$
- $(\exists x)(\forall y)I(x, y)$

Question 4

The domain of the following predicates is all integers greater than 1:

- $P(a) =$ "a is prime."
- $Q(a, b) =$ "a divides b."

Consider the following statement:

For every x that is not prime, there is some prime y that divides it. This is a true statement.

Part 1

Write the statement in predicate logic. Hint: There is a conditional ($\rightarrow$) in this statement.

Part 2

Formally negate the statement (moving the $\neg$ as far to the right as possible).

Part 3

Write the english translation of your negated sentance. Is the negated sentance a True statement? If you are having difficulty writing this in english, consider modifying the result in Part 2 to change any $\vee$ to a $\rightarrow$.