CS 173, Fall 17   Examlet 1, Part A

Name:_____

NetID:_____   **Lecture:**   A   B

Discussion: **Thursday**   **Friday**   9   10   11   12   1   2   3   4   5   6

1. (5 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

There is a violin v, such that v is not old but the maker of v is not known;

Solution: For every violin v, v is old or the maker of v is known;

2. (5 points) State the contrapositive of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

For every tiger k, if k is orange, then k is large and k is not friendly.

Solution: For every tiger k, if k is not large or k is friendly, then k is not orange.

3. (5 points) Suppose that F and G are functions whose inputs and outputs are positive real numbers, defined by $F(x) = x$ and $G(x) = x^2$. Compute the value of $G(F(G(x)))$. Simplify your answer and show your work.

Solution: Solution:

$G(x) = x^2$

So $F(G(X)) = F(x^2) = x^2$.

So $G(F(G(X))) = G(x^2) = x^4$.

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1. (5 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

> For every computer game g, if g has trendy music or g has an interesting plotline, then g is not cheap.

Solution: There is a computer game g such that g has trendy music or an interesting plotline but g is cheap.

2. (5 points) State the contrapositive of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

> For every tree t, if t is in Illinois and t is not hardy, then t is indoors.

Solution: For every tree t, if t is not indoors, then t is not in Illinois or t is hardy.

3. (5 points) List all solutions to the equation $abc = 6$, where a, b, and c are natural numbers.

Solution: Solution:

Writing the values for a, b, and c, in order, the possibilities are:

6, 1, 1	1, 6, 1	1, 1, 6
1, 3, 2	3, 2, 1	2, 1, 3
1, 2, 3	2, 3, 1	3, 1, 2

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1. (5 points) Give a truth table for the following expression and (using your truth table or other means) find a simpler expression equivalent to it.

Solution:

$$(p \rightarrow p) \rightarrow p \equiv p$$

p	$p \rightarrow p$	$(p \rightarrow p) \rightarrow p$
T	T	T
F	T	F

2. (5 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

For every dragon d, if d is green, then d is not large or d is fat.

Solution: There is a dragon d such that d is green but/and d is large and d is not fat.

3. (5 points) Suppose that G and H are functions whose inputs and outputs are real numbers, defined by $G(x) = x - 5$ and $H(x) = \sqrt{x+1}$. Compute the value of $H(H(G(13)))$, showing your work.

Solution: $G(13) = 8$. So $H(G(13)) = \sqrt{9} = 3$. So $H(H(G(13))) = \sqrt{4} = 2$.

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1. (5 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

For every mountain m, if m is tall or m is not in the north, then m has a snow cap.

Solution: There is a mountain m, such that m is tall or m is not in the north, but m does not have a snow cap.

2. (5 points) Solve $3x + 2m = \frac{w}{y}$ for x, expressing your answer as a single fraction. Simplify your answer and show your work.

Solution:

$$
\begin{aligned}
3x + 2m &= \frac{w}{y} \\
3x &= \frac{w}{y} - 2m \\
3x &= \frac{w - 2ym}{y} \\
x &= \frac{w - 2ym}{3y}
\end{aligned}
$$

3. (5 points) Give a truth table for the following expression and (using your truth table or other means) find a simpler expression equivalent to it.

Solution:

$(p \rightarrow q) \wedge (p \rightarrow \neg q) \equiv \neg p$

p	q	$p \rightarrow q$	$p \rightarrow \neg q$	$(p \rightarrow q) \wedge (p \rightarrow \neg q)$
T	T	T	F	F
T	F	F	T	F
F	T	T	T	T
F	F	T	T	T

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1. (5 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

If the date is before 1800, then every monster m is either smelly or large.

Solution: The date is before 1800, but there is a monster that is not smelly and not large.

2. (5 points) State the contrapositive of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

For every egg E, if E floats, then E is not good or the water has been salted.

Solution: For every egg E, if E is good and the water has not been salted, then E will not floats.

3. (5 points) Suppose that F and G are functions whose inputs and outputs are real numbers, defined by $F(x) = x^2 - 4x$ and $G(x) = x + 4$. Compute the value of $F(G(z))$, showing your work.

Solution: $G(z) = z + 4$.

So $F(G(z)) = F(z + 4) = (z + 4)^2 - 4(z + 4) = z^2 + 8z + 16 - 4z - 16 = z^2 + 4z$

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1. (5 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

     For every dragon d, if d is not large, then d is green or d not hungry.

Solution: There is a dragon d such that d is not large but d is not green and d is hungry.

2. (5 points) State the contrapositive of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

     For every car c, if c is a Tesla, then c is new or c is not fast.

Solution: For every car c, if c is not new and c is fast, then c is not a Tesla.

3. (5 points) Solve $\frac{3}{7x} + a = \frac{b}{7}$ for x, expressing your answer as a single fraction. Simplify your answer and show your work.

     Solution: Multiplying everything by $7x$, we get $3 + 7ax = bx$.

     So then $bx - 7ax = 3$. So $x(b - 7a) = 3$. So $x = \frac{3}{b-7a}$.

     Notice that there is no solution if $b = 7a$.