CS 173, Fall 2016
Examlet 1, Part A

NETID:

FIRST:	**LAST:**

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

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 dinosaur d, if d is huge, then d is not a juvenile and d is a sauropod.

Solution: For every dinosaur d, if d is a juvenile or d is not a sauropod, then d is not huge.

3. (5 points) Suppose that x is an integer and $x^2 + 3x - 18 < 0$. What are the possible values of x? Show your work.

Solution: $x^2 + 3x - 18 = (x + 6)(x - 3)$. So we have $(x + 6)(x - 3) < 0$. So one of $(x + 6)$ and $(x - 3)$ is negative and the other positive. Because $(x + 6)$ is larger, $(x + 6)$ must be the positive one.

So we have $x + 6 > 0$ and $x - 3 < 0$. So $x > -6$ and $x < 3$. Since x is an integer, it must be one of the following values:

$$-5, -4, -3, -2, -1, 0, 1, 2$$

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

1. (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.

2. (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 relish r such that r is orange but r is not spicy.

Solution: For every relish r, r is not orange or r is spicy.

3. (5 points) Describe all (real) solutions to the equation $(x+y)^2 \leq x^2+y^2$. Show your work.

Solution: Notice that $(x+y)^2) = x^2+2xy+y^2$. So our equation is equivalent to $x^2+2xy+y^2 \leq x^2+y^2$, i.e. $2xy \leq 0$. This will hold when (a) x or y is zero or (b) one of x and y is negative and the other is positive.

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

For every book b, if b is blue or b is not heavy, then b is not a math book.

Solution: For every book b, if b is a math book, then b is not blue and b is heavy.

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

Solution: There is a tiger k such that k is not large or k is friendly, but k is orange.

3. (5 points) Recall that $i = \sqrt{-1}$. Compute the value of $(1+i)(2-i)(3-i)$. Show your work.

Solution: $(1+i)(2-i)(3-i) = (2+2i-i-i^2)(3-i) = (2+i+1)(3-i) = (3+i)(3-i)$ But then $(3+i)(3-i) = 9+3i-3i-i^2 = 9-i^2 = 9+1 = 10$

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1. (5 points) Show that the following two expressions are not logically equivalent, by giving specific values of p, q, and r for which they produce different values.

$(p \rightarrow q) \wedge r$

$p \rightarrow (q \wedge r)$

Solution: Set p and r to be false and q to be true. Then $(p \rightarrow q)$ is true (because its hypothesis is false) and $(p \rightarrow q) \wedge r$. But $p \rightarrow (q \wedge r)$ is true because its hypothesis is false.

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 dog d, if d is a terrier, then d is not large and d is noisy.

Solution: For every dog d, if d is large or d is not noisy, then d is not a terrier.

3. (5 points) Solve $16p^2 - 81 = 0$ for p. Simplify your answer and show your work.

Solution: $16p^2 - 81 = (4p - 9)(4p + 9)$

$(4p - 9)(4p + 9) = 0$ when either $4p = 9$ or $4p = -9$. That is $p = \pm\frac{9}{4}$

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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 tree t, if t grows in Canada, then t is not tall or t is a conifer.

Solution: There is a tree t, such that g is tall and t is not a conifer, bug t grows in Canada.

2. (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 $H(H(G(13))) = \sqrt{4} = 2$.

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:

$p \wedge (p \vee q) = p$

p	q	$p \vee q$	$p \wedge (p \vee q)$
T	T	T	T
T	F	T	T
F	T	T	F
F	F	F	F

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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 relish r, if r is orange and r is not spicy, then r is pungent.

Solution: There is a relish r, such that r is orange and r is not spicy but r is not pungent.

2. (5 points) Suppose that F and G are functions whose inputs and outputs are real numbers, defined by $F(x) = x - 6$ and $G(x) = x^2 + 8$.

Compute the value of $\frac{F(F(G(2)))}{F(\pi)}$. Simplify your answer and show your work.

Solution: $G(2) = 4 + 8 = 12$. So $F(F(G(2))) = (12 - 6) - 6 = 0$. So $\frac{F(F(G(2)))}{F(\pi)} = \frac{0}{F(\pi)} = 0$.

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:

$r \rightarrow (q \rightarrow r) = T$

q	r	$q \rightarrow r$	$r \rightarrow (q \rightarrow r)$
T	T	T	T
T	F	F	T
F	T	T	T
F	F	T	T