CS 173, Spring 2015
Examlet 1, Part A

NETID:

FIRST:

LAST:

Discussion: Monday 9 10 11 12 1 2 3 4 5

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

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

2. (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.

$(p \wedge q) \vee q =$ **Solution:** q

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

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

Claim: For every cat c, if c is not fierce or c wears a collar, then c is a pet.

1. (5 points) Negation

   Solution: There exists a cat c that is either not fierce or wears a collar and is not a pet.

2. (5 points) Contrapositive

   Solution: For every cat c, if c is not a pet, then c is fierce and c does not wear a collar.

3. (5 points) Solve $5x + m = \frac{n}{5}$ for x, expressing your answer as a single fraction. Show your work.

Solution:

$$\begin{aligned} 5x + m &= \frac{n}{5} \\ 5x &= \frac{n}{5} - m \\ x &= \frac{n}{25} - \frac{m}{5} = \frac{n - 5m}{25} \end{aligned}$$

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

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

1. (5 points) Negation

   Solution: There exists an orange tiger k that is not large or is friendly.

2. (5 points) Contrapositive

   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 $F(x) = x^2 + 14x$ and $G(x) = \sqrt{x + 49}$. Compute the value of $G(F(p))$. Simplify your answer and show your work.

Solution: Notice that p is given to be positive, so $p + 7$ is also positive.

$G(F(p)) = G(p^2 + 14p) = \sqrt{(p^2 + 14p) + 49} = \sqrt{(p + 7)^2} = p + 7$

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

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

1. (5 points) Negation

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

2. (5 points) Contrapositive

   Solution: For every dragon d, if d is large and d is not fat, then d is not green.

3. (5 points) Solve $\frac{3}{x} + m = \frac{3}{p}$ for x, expressing your answer as a single fraction. Show your work.

Solution: Multiplying by xp gives you $3p + mxp = 3x$.

So $3x - mxp = 3p$.

So $x(3 - mp) = 3p$.

So $x = \frac{3p}{3-mp}$.

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

Claim: For every dinosaur d, if d is huge, then d is not a juvenile and d is a sauropod.

1. (5 points) Negation

   Solution: There is a dinosaur d such that d is huge but d is a juvenile or d is not a sauropod.

2. (5 points) Contrapositive

   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 k is a positive integer, x is a positive real number, and $\frac{1}{k} = x + \frac{1}{6}$. What are the possible values for k? (Hint: k is an INTEGER.) Briefly explain or show work.

Solution: Observe that we can rearrange the equation as follows:

Since x is positive, $\frac{1}{k} = x + \frac{1}{6}$ implies that $\frac{1}{k} > \frac{1}{6}$. So k must be smaller than 6. But we were told that k was a positive integer. The only positive integers smaller than 6 are 1, 2, 3, 4, and 5.

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

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

1. (5 points) Negation

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

2. (5 points) Contrapositive

   Solution: For all dragons d, if d is large and d is not fat, then d is not green.

3. (5 points) Solve $16p^2 - 81 = 0$ for p. 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 $p = \pm\frac{9}{4}$