CS 173, Fall 2015
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 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.

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

Solution:

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

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

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

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

Solution: There is a book b, such that b is blue or b is not heavy, but b is a math book.

3. (5 points) Suppose that G and H are functions whose inputs and outputs are real numbers, defined by $G(x) = x + 7$ and $H(x) = \sqrt{x-1}$. Compute the value of $G(H(H(2)))$, showing your work.

Solution: $H(2) = \sqrt{1} = 1$

So $H(H(2)) = \sqrt{0} = 0$.

So $G(H(H(8))) = 0 + 7 = 7$

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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 any student s, if s rides a bicycle, then s wears a helmet or s has no fear of death.

Solution: For any student s, if s doesn't wear a helment and s fears death, then s doesn't ride a bicycle.

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 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.

3. (5 points) Solve $\frac{4p^2 - 9}{2p + 3} = 5$ for p. Show your work.

Solution: $4p^2 - 9 = (2p - 3)(2p + 3)$. So $\frac{4p^2 - 9}{2p + 3} = 2p - 3$. So $2p - 3 = 5$. This means that $2p = 8$. So $p = 4$.

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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 any student s, if s rides a bicycle, then s wears a helmet or s has no fear of death.

Solution: There is a student s who rides a bicycle but doesn't wear a helmet and fears death.

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 small and d is not a juvenile, then d is not a sauropod.

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

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 an integer greater than 6.

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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.

There is a dorm room d, such that d has green walls and d has no window.

Solution: For every dorm room d, d has walls that aren't green or d has a window.

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

Solution: For every tree t, if g is tall and t is not a conifer, then t doesn't grow in Canada.

3. (5 points) Suppose that m and p are positive integers such that $2p^2 + mp < 6$. What are the possible values for m? Briefly explain or show work.

Solution: Since $2p^2 + mp < 6$, $mp < 6 - 2p^2$. Since p is a positive integer $2p^2 \geq 2$. So $6 - 2p^2 \leq 4$. So $mp < 4$. Since m is a positive integer, this implies that m is 1, 2, or 3.

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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 any bear b, if b is blue and b talks, then b is fuzzy.

Solution: For any bear b, if b is not fuzzy, then b is not blue or b doesn't talk.

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.

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