Quiz 1

Key

Show *all* your work. No credit is given without reasonable supporting work. There are *two* sides to this quiz and all logic symbols make use of the textbook notation.

1. Consider the following sentences:
   p := "I come to class." t:= "The teacher is awesome." q:= "There is a quiz."

   (a) [2] (LogicWks #1) Determine if each of the above sentences are propositions.

   p is a proposition +.5

   t not a proposition +.5

   q is a proposition +.5

   (b) [2] (HW1 §1.1 #1) Express $\neg q \wedge p$ in an English sentence.

   There is not a quiz +.5 and +.5 I came to class

   p +.5
   q +.5

   (c) [2] (§1.1 #27) State the contrapositive of the statement:
   "If there is a quiz, then I come to class".

   $q \to p$ order +.5

   Contrapositive +.5 $p \to$ +.5 $\neg q$.

   If I don't come to class then there was no quiz +.5

2. [3] (HW1 §1.3 #3) Find a compound proposition involving the propositional variables a, b, and c that is true when a and b are true and c is false, but false otherwise.

   $a \wedge b \wedge \neg c$

   +.5 notation
   +1 if returns true when a=b=T & c=F
   +1.5 if only returns true when a=b=T & c=F

3. (HW1 §1.4 #5) Consider the following statement,
"Every koala can climb or speak English."

(a) [3] Express the statement above using quantifiers.

(+1) Domain: Koalas.

(+1) $C(x)$: x can climb.
$E(x)$: x can speak English.

(+5) $\forall x \; C(x) \vee E(x)$ (+5)

(b) [2] Negate part (a) so that no negation symbol is to the left of a quantifier.

$\neg(\forall x \; C(x) \vee E(x))$

$\exists x \; \neg[C(x) \vee E(x)]$ or $\exists x \; (\neg C(x)) \wedge (\neg E(x))$

4. [2] (logic wks #2) Let the domain be integers between -2 and 3 inclusive. Determine the truth value of $\forall x, (x + 3 \geq 0)$. Justify yourself. → computations (+5)

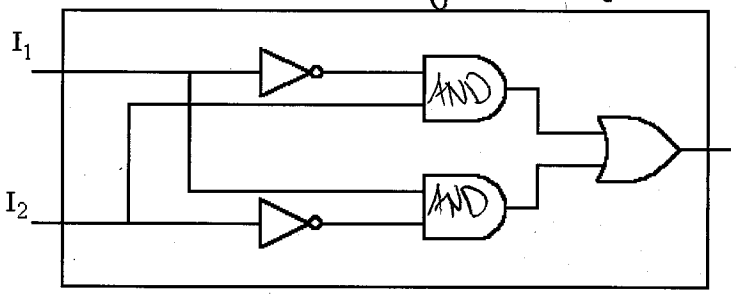
$x = -2$ $\quad -2+3 \geq 0$ ✓
$x = -1$ $\quad -1+3 \geq 0$ ✓
$x = 0$ $\quad 0+3 \geq 0$ ✓
$x = 1$ $\quad 1+3 \geq 0$ ✓
$x = 2$ $\quad 2+3 \geq 0$ ✓
$x = 3$ $\quad 3+3 \geq 0$ ✓

True (+5)

repeated ands (+5)

5. Consider the following combinator

say what they mean (5)



(a) [3] (§1.2 #41)
Find the output of the combinatorial circuit.

(b) [1] Can you write the output of the combinatorial circuit using only one logical connective?

where 0 is like false ↓
1 is like true..

a) $(\neg I_1 \wedge I_2) \vee (I_1 \wedge \neg I_2)$

b)

I_1	I_2	$(\neg I_1 \wedge I_2) \vee (I_1 \wedge \neg I_2)$
0	0	0
0	1	1
1	0	1
1	1	0

So xor will work

$I_1 \oplus I_2$