CSE311: Quiz Section, 10/13/2011

October 13, 2011

Reminder about homework:

Be sure to read the homework questions VERY carefully. Apparently people lost points on homework 1 by not quite answering the question that was asked.

Answers: I won't be posting any answers for this worksheet, because I've taken all of the problems (except the first one) from odd-numbered problems in the text book, which means the answers are in the back of the book. I've given you the problem numbers for the 6th and 7th editions. (Sorry, I don't have access to a 5th edition.) Please note that where the a) b) c) enumeration don't match up, I've put the original letter at the end of the item.

1. Translate English to logical expressions, varying domains

   For each one of these, translate twice: once with a domain of all students in the class and once with a domain of all people.

   (a) Someone in the class is a rodeo clown.

   (b) Everyone in the class is a secret agent.

   (c) A student in the class has been accused of game show fraud.

   (d) There is no person in the class who is not an evil wizard.

2. Logical equivalence with quantifiers

   7th edition: 1.4: 43, 45;   6th edition: 1.3: 43, 45

   Determine whether the following are logically equivalent:

   (a) $\forall x(P(x) \to Q(x))$ and $\forall x P(x) \to \forall x Q(x)$

   (b) $\exists x(P(x) \vee Q(x))$ and $\exists x P(x) \vee \exists x Q(x)$

3. Translate English to logical expressions with nested quantifiers.

   Both editions: 1.5: 9

   Let L(x,y) be the statement "x loves y"

   (a) There is somebody whom everybody loves (c)

   (b) Nobody loves everybody (d)

(c) There is exactly one person whom everybody loves. (g)

(d) Everyone loves himself or herself. (i)

(e) There is someone who loves no one besides himself or herself. (j)

4. Translate nested quantifiers into English

   7th edition: 1.5: 25; 6th edition: 1.4: 25

   For all of these the domain is all real numbers...

   (a) $\exists x \forall y (xy = y)$ (a)

   (b) $\exists x \exists y ((x^2 > y) \land (x < y))$ (c)

   (c) $\forall x \forall y \exists z (x + y = z)$ (d)

5. Negating quantifiers

   7th edition: 1.5: 33; 6th edition: 1.4: 33

   Move the negations to appear only within predicates (that is, no negation is outside a quantifier or an expression involving logical connectives).

   (a) $\neg \forall x \forall y P(x, y)$

   (b) $\neg \forall y \exists x P(x, y)$

   (c) $\neg \forall y \forall x (P(x, y) \lor Q(x, y))$

   (d) $\neg (\exists x \exists y \neg P(x, y) \land \forall x \forall y Q(x, y))$

6. Using inference rules and equivalences to prove that given premises imply a conclusion

   7th edition: 1.6: Examples 6 and 7; 6th edition: 1.5: Examples 6 and 7

   Show that the given premises imply the conclusion

   (a) Premises: $\neg p \land q$, $r \to p$, $\neg r \to s$, $s \to t$
   Conclusion: t

   (b) Premises: $p \to q$, $\neg p \to r$, $r \to s$
   Conclusion: $\neg q \to s$

7. Use inference rules with quantified premises and conclusions

   7th edition: 1.6: 27, 29; 6th edition: 1.5: 27, 29

   (a) Premises: $\forall x (P(x) \to (Q(x) \land S(x)))$, $\forall x (P(x) \land R(x))$
   Conclusion: $\forall x (R(x) \land S(x))$

   (b) Premises: $\forall x (P(x) \lor Q(x))$, $\forall x (\neg Q(x) \lor S(x))$, $\forall x (R(x) \to \neg S(x))$, $\exists x \neg P(x)$
   Conclusion: $\exists x \neg R(x)$

8. Explanation of the extra credit problem for homework #2

   (Richard well also send out a write-up of this solution.)