CSCE476/876 **Spring 2005**

BONUS: Homework 8

Assigned on: Wed April 20, 2005.

Due: Wed April 27, 2005.

This is a pen-and-paper homework, to be returned in class.
The whole homework is worth 84 points.
This is a bonus homework: points apply only towards the homework component of the final grade.

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1. Using the inference rules for logic **(10 points)**
prove that "$\exists\, x Z(x)$ follows from the givens." Be sure to justify your steps by stating the inference rule used, along with the previous line(s) to which it was applied and the unifications used.

(a)	$P(1)$	given
(b)	$W(1) \wedge W(2) \wedge W(3)$	given
(c)	$\forall x[P(x) \Rightarrow \neg R(x)]$	given
(d)	$\forall x[Q(x) \vee R(x)]$	given
(e)	$\forall x[(Q(x) \wedge W(x)) \Rightarrow Z(x)]$	given

2. AIMA 8.4, page 268. **(2 points)**

3. AIMA 8.6, page 268. **(22 points)**

4. AIMA 8.7, page 269. **(4 points)**

5. Axioms in FOL *(Adapted from AIMA, first edition)* **(15 points)**

   Using the following:
   `Child(x,y)`, `Sibling(x,y)`, `Female(x)`, `Male(x)`, and `Spouse (x, y)`:

   - (10 points) Write axioms describing the predicates: `GrandChild`, `GreatGrandParent`, `Brother`, `Sister`, `Daughter`, `Son`, `Aunt`, `Uncle`, `BrotherInLaw`, `SisterInLaw`, and `FirstCousin`. We want these axioms to be definitions, so use $\Leftrightarrow$ instead of $\Rightarrow$.
   - (5 points) Knowing that a second cousin is a child of one's parent first cousin, write the definition of a N^{th}`-cousin`, as a recursive expression in terms of the predicates defined above. Hint: Let N^{th}`-cousin` be a ternary predicate, that takes as input n, and two persons p_1 and p_2.

6. AIMA 9.3, page 315. **(3 points)**

7. AIMA 9.4, page 316. **(4 points)**

8. AIMA 9.9, page 316. **(12 points)**

9. AIMA 9.10, page 317. **(12 points)**

   For question (d), it is useful to check the following reference: Smith, D.E., Genesereth, M.R., and Ginsberg, M.L. (1986). *Controlling recursive inference.* Artificial Intelligence, Volume 30 (3), pages 343–389. (Page 1036, AIMA2e)