CSE 571 – Artificial Intelligence

Mid Term
8th March 2001
(100 pts)

(1) Consider an AnsProlog language with constants: a, b, and c, variables: X, Y, and Z, predicates: p and q of arity one, and functions: f and g of arity one. For the following expressions label them as: Belongs to Herbarnd base, Belongs to Herbrand Universe, Belongs to both, Belongs to neither. (16 pts)

(i) $p(a)$ (ii) $p(X)$ (iii) $p(f(g(a)))$ (iv) $f(a)$ (v) $f(p(b))$ (vi) $b(a)$ (vii) $q(p(c))$ (viii) a

(2) Consider the following program and answer the questions following it. (12 pts)

$q(a) \leftarrow p(b).$
$q(b) \leftarrow p(a).$
$p(b) \leftarrow .$
$p(c) \leftarrow .$

1. Is $\{p(b), p(c), q(a), q(c)\}$ a model of this program? Is it a minimal model? Explain briefly.
2. Is $\{p(b), p(c), p(a), q(b)\}$ a model of this program? Is it a minimal model? Explain briefly.
3. Is $\{p(b), p(c), q(a)\}$ a model of this program? Is it a minimal model? Explain briefly.

(3) Consider the following program:

$p \leftarrow not\ p.$
$p \leftarrow not\ q.$
$q \leftarrow not\ r.$
$r \leftarrow not\ q.$

Split the above program so that the first two rules belong to the top and the last two rules belong to the bottom. Compute the answer sets of this program and clearly say what they are. (Show your calculation steps.) (10 pts)

(4) Write the following in AnsProlog so that you can conclude Mike has a Ph.D and Carol does not. (12pts)

Normally instructors have a Ph.D. Instructors who are TAs are exceptions. Mike is an instructor. Carol is an instructor and a TA.

(5) Express the following in AnsProlog or Smodels. There are 10 students: $s1, s2, \ldots s10$. They need to be assigned into 4 dormitory rooms a, b, c, and d, so that each room has at most three students assigned and no student is assigned to more than one rooms. (You may assume that your program has facts such as $student(s1), \ldots, student(s12)$, and $room(a), \ldots, room(d)$.) Give intuitive meaning of your predicates. (12 pts)

Now add the following constraints In AnsProlog (cardinality constructs from Smodels are not allowed.) (5+5+7+7+6+8=38)

1. $s3$ and $s4$ are in different rooms.
2. $s5$ and $s6$ are in the same room.
3. Each room has at least 2 students.
4. Room c has exactly two students assigned.
5. We have a predicate $friend(X, Y)$ meaning that X and Y are friends.
   (a) For the student $s7$ at least one of his friends is assigned the same room as $s7$.
   (b) For the student $s9$ all his friends are assigned the same room as $s9$.