AI Assignment: First-order Logic

Date: 12.3.2009 **Max Marks: [25]**
Deadline: To be submitted by **19th Mar 2009**.

Use the prover9 package available at http://www.cs.unm.edu/~mccune/mace4/ for solving the following questions. Give names to your files as: q1.txt, q2.txt, etc., one for each question. Put all the files in a directory whose name is your roll-number. Tar, gzip the directory and submit. Your TAs will give you further instructions for submission.

Q1. Translate the following description of the blocks world domain into predicate logic. Make sure to capture the intention, instead of giving a word-by-word translation. Your task is to design the predicates and functions to use. **[5]**

"There are a set of cubic blocks on a table. The blocks can be stacked, but only one block can fit directly on top of another block. A robot arm can pick up a block and move it to another position, either on the table or on top of another block. The arm can only pick up one block at a time. So it cannot pick up a block that has another one on it."

Q2. Using the notation that you created in Q1, express the following scenarios, where A,B,C are blocks: **[5]**

Scenario 1: A and B are on the table and C is on top of A.
Scenario 2: C is on the table, B is on top of C and A is on top of B.

Q3. Let there be n blocks, A1,…,An. Let each one have a colour from the domain {red, green, blue}. Express the following in predicate logic. **[5]**

1. Every red block is on top of a blue block.
2. Every green block is on top of a red block.
3. There are three blocks each of a different colour.

Prove using resolution that there is only one block on the table and it is a blue block.

Q4. Express in predicate logic: **[10]**

(i) A block must have a unique (one and only one) colour.
(ii) There are 3 blocks (A,B,C) each of a different colour among {red,green,blue}.
(iii) If block A is red or block B is blue, then block C is blue.
(iv) If block A is red, then block C is red.
(v) Block A is not blue.
(vi) If block A is green

Determine the colour of as many blocks as possible. Show the proofs.