UVA WELLASSA UNIVERSITY
FACULTY OF SCIENCE AND TECHNOLOGY
COMPUTER SCIENCE & TECHNOLOGY DEGREE PROGRAM
FIRST SEMESTER EXAMINATION JAN/FEB-2011
ARTIFICIAL INTELLIGENCE (CST306-3)
&
REPEATERS (CST307-3 ARTIFICIAL INTELLIGENCE)

Time Allowed: 3 hours Answer 05 questions only

Q1. Are the following statements true or false? Explain why or why not.

a) A number of philosophers and mathematicians, notably Descartes, Leibniz, Hobbes, Boole and Turing, have argued that intelligent thought is simply logical calculation.
b) A machine has passed the Turing test for intelligence.
c) Weak AI advocates believe that a machine will never achieve intelligent thought.
d) The most successful chess programs can defeat grand masters because they can look at all possible moves in a game.
e) Expert systems, reasoning in terms of formal rules, have achieved some success in limited subject domains.
f) Backward chaining inference is especially suitable for engineering design problems.
g) Forward chaining inference is especially suitable for diagnosis or troubleshooting.
h) Semantic networks, frames and classes all share a similar technique for inferring common properties.
i) A perceptron learns by asking its trainer to give it more examples.
j) Back-propagation, like a child learning how to talk, learns by propagating error values back to hidden units and input units, causing them to adjust their weights to give better results.

20 marks

Q2. Suppose you are searching for a girl's name written using only the letters D, N and A. You have the letters ordered alphabetically (A, D, N) and you start writing down possibilities:

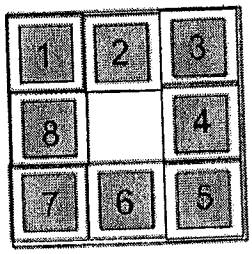
A, D, N, AA, AD, AN, DA, DD, DN, NA, ND, NN, ...

a) How many strings of four or fewer letters are there where the letters are D, N or A?

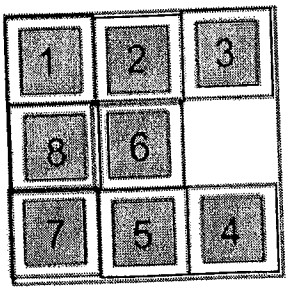
b) In the above possibilities, are you searching in a depth first or breadth first way?
c) What are the next three possible names you would write down?
d) How many possibilities will you write down before getting to the name ANNA?
e) Are you guaranteed to find all girls names with letters D, N and A in this manner?

20 marks

Q3. A solved 8-puzzle game looks like this:



Given a puzzle state like the one below, where the numbers are in the wrong places, we want to search for a series of moves which ends in the solution above. A path cost could be calculated as the number of moves required.



a) Write down a heuristic function, *h*, for this game (remember that this *estimates* the path cost from a particular state to the solution).
b) What is the value of *h* for the above board state?
c) In a greedy search, what move would be chosen next? (i.e., move the 3, the 4 or the 6 into the gap?)
d) Is this heuristic *admissable*?
e) Can you suggest a better heuristic measure?

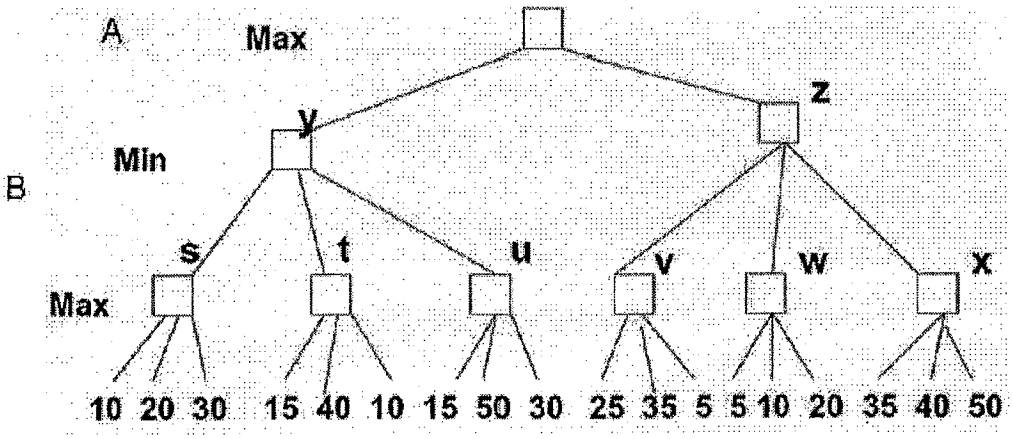
20 marks

Q4.

a) Consider the following sentences. For each of them, explain if it can be written out in firstorder logic. If your answer is yes, give the corresponding logical statement. If the answer is no, explain the difficulty.

I. All the existing kinds of birds can fly
II. Some existing kinds of birds can fly
III. At least two existing kinds of birds can fly
IV. Most existing kinds of birds can fly
V. All existing kinds of birds can fly, except two.

b) Game tree search Consider the game tree below



I. Use minimax to determine the best strategy for both players, and give the actions that would be chosen and their values.
II. How would you re-order the nodes in order to get maximal pruning when using the alpha-beta algorithm? Feel free to use the figure to show the re-ordering

20 marks

Q5.

a) Give a general definition of an *agent*, and then explain how a *simple reflex agent* operates.
b) Four additional features that can be built into AI agents are: *internal states, goals, utility functions*, and *learning*. Explain how each of these can enable an agent to act more intelligently. Illustrate your answer with some simple examples.
c) In describing intelligent agents it is often convenient to specify them in terms of Percepts, Actions, Goals and Environment. State briefly what each of these PAGE concepts mean.
d) List what these PAGE concepts correspond to in the following agents:
   I. A medical diagnostic system.
   II. A refinery controller
   III. An interactive Spanish language tutor.

20 marks

Q6.

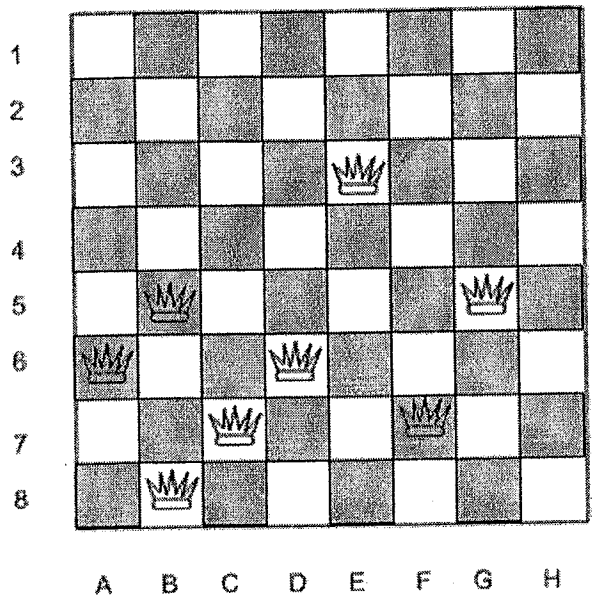
a) What are the main aspects of building rule based expert systems that can be usefully assisted by using machine learning techniques?

b) Explain the distinction between *inductive rule learning* and *deductive rule learning*. Describe how each approach works.

c) Draw a flowchart for a simple *rule induction system*. Explain what happens at each stage of the induction process.

d) Outline the important operations that a good *rule refinement program* should be able to perform. Explain why each operation is useful.

e) Suppose you are using a gradient descent search with the evaluation function "number of queens which are threatened by another queen" in the 8-queens problem. Suppose that you're at the following board state:



I. What is the current score for the evaluation function?

II. Write down some of the best moves from this position (queens can be moved anywhere).

III. Give an example of an illegal move (in a gradient descent search).

IV. What do you do if there are no legal moves?

20 marks