UVA WELLASSA UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & TECHNOLOGY

FIRST SEMESTER EXAMINATION FEB/MAR – 2012

CST307-3 INTELIGENT SYSTEMS

Time Allowed: Three (3) hours

This paper has four questions, answer all questions

Q1

a. Explain briefly (2 or 3 sentences each) the difference between:
   i. Depth-first search and iterative deepening search.
   ii. State space search and game tree evaluation.
   iii. Top-down parsing and bottom-up parsing.
   iv. A perception and a feed-forward, back-propagation neural network.
b. Explain what is the spectrum of robot control?
c. Write about Robot control approaches and describe them with two examples for each

[25 marks]

Q2

a. If you are given an expert system shell, what should be your first step in order to develop an expert system?
b. Consider software which diagnoses heart disease by analyzing an ECG. Can we consider this software as an expert system? Justify your answer.
c. In what characteristics are Artificial Neural Networks (ANNs) different from other artificial intelligent tools?
d. How suited would PROLOG be in implementing the search algorithms? Comment on how this might be done and what difficulties might exist.
e. Write an algorithm to perform a breadth first search for a graph making sure your algorithm works when a signals node is generated at more than one level of the graph.

[25 marks]

Q3

a. What is the search mechanism used in Prolog?
b. Represent the following statements in Prolog.

i. 12 is an integer.
ii. If a number is an integer and positive it is called a positive integer.
iii. Someone is an ancestor if he or she is either a parent or a parental predecessor.

c. Consider the following Prolog code fragment.

```
modulex([],L,L).

modulex([H|T],L2,[H|Y]) :- modulex(T,L2,Y).
```

What will be the output produced for the following input?

```
Q : modulex([a,b,c,d],[e,f,g,h],X).
```

d. Suppose a robot is about to enter a maze about which it has no information. The robot has the goal of finding the EXIT of the maze starting from the ENTRANCE with minimum effort. What is the best searching technique the robot should utilize if it wants to save fuel? Justify your answer.
e. Express the three following logic expressions in natural language.

i. ∀X(student(X) → ~ bright(X))
ii. ∀X(human(X) ^ (male(X) V female(X)))
iii. [∀X(god(Y) ^ loves(Y,X))] ^ [∀X(god(Y) ^ ~loves(X,Y))]

[25 marks]

Q4 Consider the following inference: Given the rules and facts,

R1: If X is a close relative of Y and Y is a close relative of Z then X is acquainted with Z.
R2: If X is a parent of Y, then X is a close relative of Y.
R3: If X is married to Y, then X is a close relative of Y.
F1: Sam is a parent of Mike.
F2: Mike is married to Alice.

Infer that Sam is acquainted with Alice.

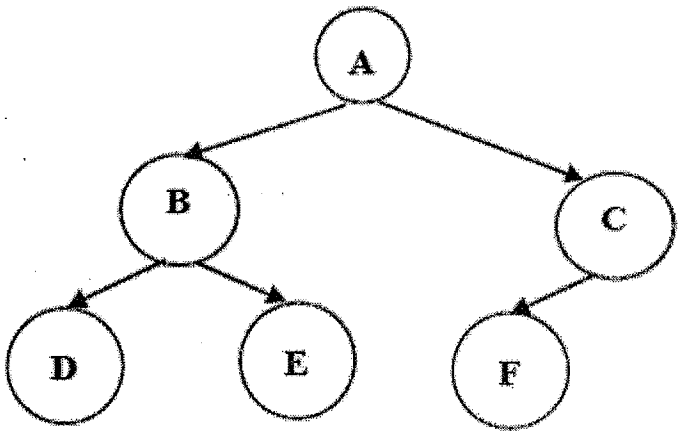
a. Express rules R1-R3 and facts F1,F2 in the Datalog representation using the following primitives:

c(X,Y) --- X is a close relative of Y.
p(X,Y) --- X is a parent of Y.
m(X,Y) --- X is married to Y.
a(X,Y) --- X is acquainted with Y.
sam, mike, alice : Constants.

b. Explain how Datalog can carry out the inference. You may use either backward or forward chaining.

c. Show how Breath-First-Search and Depth-First-Search can be implemented using some appropriate pseudo-code. If you use another search algorithm as a sub-routine then show this algorithm in detail as well.

d. For the search tree below, show at each step what nodes are in the queue for both the Breath-First-Search and Depth-First-Search. Show the list of nodes that are expanded.



e. What is the worst-case time and space complexity of the above two algorithms.

(25 marks)