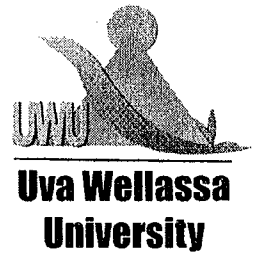


Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
300 level 1st Semester Examination – Jul./Aug. 2016
CST351-3 Artificial Intelligent Systems



Instructions to candidates

Duration: Three (03) hours

Number of questions: Six (06)

Answer all questions

Mark allocation: 120

- 1.
- a. Explain “acting humanly” using a Turing test. (2 mark)

 - b. Define the following terms in your own words.
 - i. Model-based agent
 - ii. Goal-based agent
 - iii. Utility-based agent
 - iv. Learning agent(8 mark)

 - c. Give examples to performance measure, environment, actuators and sensors of an intelligent taxi driver agent. (4 mark)

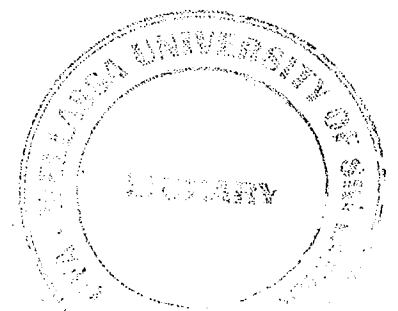
 - d. Differentiate the following environment types of intelligent agents.
 - i. Fully observable vs partially observable
 - ii. Deterministic vs stochastic
 - iii. Episodic vs sequential(6 mark)
2. Consider the 8-puzzle problem for answering the following questions. The initial state and the goal state are illustrated in Figure 1 and Figure 2.

1	4	2
3	7	5
6		8

Figure 1: Initial State

	1	2
3	4	5
6	7	8

Figure 2: Goal State



- a. Define initial state, actions, transition model, goal test and path cost by considering the above example. (5 mark)
- b. Illustrate the state expansion using a search tree diagram of the breadth-first search for finding the goal state (Figure 2) from the initial state (Figure 1). (5 mark)
- c. Depict state expansions after applying the Greedy search algorithm to the above example for finding the goal state (Figure 2) from the initial state (Figure 1). Hint: the heuristic function ($h(n)$) is, the number of misplaced tiles in the current state relative to the goal state. (6 mark)
- d. Explain advantages of Greedy search algorithm compared with A* search algorithm using an example. (4 mark)

3.

- a. Use the truth table method to compute $(\neg p \vee q) \wedge (q \rightarrow \neg r \wedge \neg p) \wedge (p \vee r)$. (5 mark)
- b. Formalize the following sentences using first order logic formulas.
 - i. All Students are smart.
 - ii. There exists a smart student.
 - iii. Every student loves some student.
 - iv. Kamal takes either Math or Biology (but not both).
 - v. None of the students loves Amal.

(5 mark)
- c. Giving all the steps, reduce the formula $(\neg p \rightarrow q) \rightarrow (q \rightarrow \neg r)$ to conjunctive normal form. (5 mark)
- d. Draw a proof tree generated by forward chaining to the following paragraph for proving that Sirimal is a criminal.

The law says that it is a crime for a Sri Lankan to sell weapons to hostile nations. The country C1, an enemy of Sri Lanka, has some missiles, and all of its missiles were sold to C1 by Sirimal, who is a Sri Lankan. (5 mark)

4.

- a. Define inductive and deductive learning. (2 mark)
- b. Explain range finders, location sensors and proprioceptive sensors using examples. (3 mark)
- c. Compare reactive and subsumption control architectures using schematic diagrams. (7 mark)

d. Explain learning system classification based on the goal, tasks and target function using examples. (8 mark)

5.

a. Illustrate the basic structure of a rule-based expert system. (5 mark)

b. Compare forward and backward chaining rule-based expert systems. (4 mark)

c. Consider the following expert systems whose database consists of the facts A, B, C, D, E and whose knowledge base is given by the rules below. Show how forward chaining can be applied to this system to reach the conclusion Z. (7 mark)

Rule 1: IF A is true
AND C is true
THEN B is true

Rule 2: IF C is true
AND D is true
THEN F is true

Rule 3: IF C is true
AND D is true
AND E is true
THEN X is true

Rule 4: IF A is true
AND B is true
AND X is true
THEN Y is true

Rule 5: IF D is true
AND Y is true
THEN Z is true

d. Describe four (04) different categories based on the system's overall architecture of the hybrid intelligent architectures. (4 mark)

6.

a. Assume that you have following prolog program. Draw derivation tree for predecessor(saman, amal) using the following program. (6 mark)

```
parent(amal, prasanna). %Fact 1
parent(nayana, amal). %Fact 2
parent(saman, nayana). %Fact 3
predecessor(X,Y) :- parent(X,Y). %Rule 1
predecessor(X,Y) :- parent(X,Z),predecessor(Z,Y). %Rule 2
```

b. Write a prolog program to check whether the given element is a member of the given list or not. (5 mark)

c. Write length(L,N) to calculate length N of a list L. (5 mark)

d. Define meanings of following testing types of the Prolog.

- i. integer(X)
- ii. var(X)
- iii. nonvar(X)
- iv. atomic(X)

