THE OPEN UNIVERSITY OF SRI LANKA

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

FINAL EXAMINATION 2015/2016

BACHELOR OF TECHNOLOGY PROGRAMME – COMPUTER ENGINEERING

ECX6240 – KNOWLEDGE ENGINEERING

Date: 04th December 2016	Time: 09.30 – 12.30 P.M.

This paper contains SEVEN (07) *questions on 5 pages. Answer* ONLY FIVE (5) *questions*:

Q1

i. Express the following English sentences in First Order Logic (predicate logic) using standard notations.

    a). No two OUSL students have the same ID number   (2 marks)

    b). All OUSL students except who are doing Art like Computer Engineering courses   (2 marks)

    c). No person buys an expensive Life Insurance Policy   (2 marks)

ii. Write Prolog codes for the following tasks.

    a). To calculate the length of a given list of items.
    length([a,b,c], X).
    X=3   (2 marks)

    b). To find whether a given item X appears in a given list L. For example, member(X, L) is true if X appears in the list L; otherwise false.   (2 marks)

    c). To define the predicate disjoint(L, K) true if L and K are disjoint i.e. if they have no elements in common. Where L and K are lists.

    e.g. disjoint([2, 4, 3,9], [1,5,6,7]) is true
    [Hint: use the member relation written in **part c** above].   (3 marks)

iii. Considering the following knowledgebase written in Prolog, answer the below questions.

person(registration-number, name, street-and-no, postal-code, gender)
married(registration-number-for-husband, registration-number-for-wife)
offspring(registration-number-for-father, registration-number-for-child)
postalcode(postal-code, city)

a). Find the City where Mr. Perera is living. (2marks)

b). Given the child registration number 1101 find the registration number of the mother. (2 marks)

c). Write a Prolog predicate to find separated couples.
[Hint: may be having different addresses] (3 marks)

Q2

i. Explain any TWO Knowledge Representation techniques with examples (2 marks)

ii. Represent the following relationships given in sentences by a semantic network.

Every vehicle is a physical object. Every car is a vehicle. Every car has four wheels. Electrical system is a part of a car. Battery is a part of electrical system. Pollution system is a part of every vehicle is used in transportation. Suzuki is a car. (8 marks)

iii. Consider the game tree given below in which the static scores are from first player's point of view. Suppose the first player is a maximizing player. Applying mini-max search, show the backed-up values in the tree. If the nodes are expanded from left to right, state what nodes would not be visited using alpha-beta pruning.
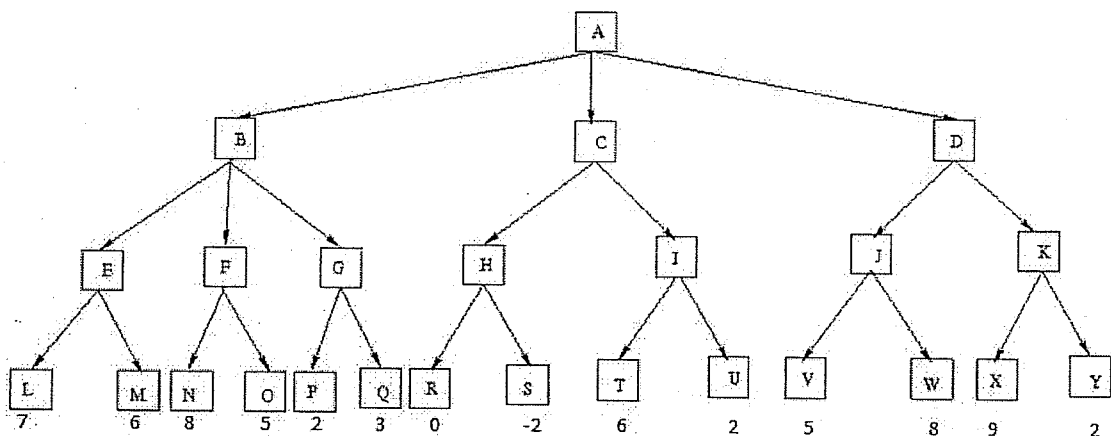

(10 marks)

Q3

Consider the following path-finding problem. One can move from one small triangle to another if they share a vertex (e.g., A can go to B and C). However, the goal G can only be accessed from F. The number after the letter is the heuristic function value for that state. The actual cost of each move is as follows:
- A move down one level (e.g. A → C or B→ E) costs 1
- A move sideways on the same level (e.g. C → B or E → F) costs 2
- A move up one level (e.g. B → A or C → A) costs 3
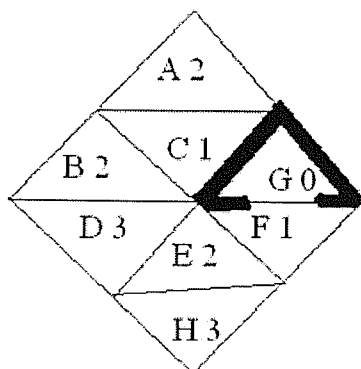
(i) Show the search tree for performing Depth-First Search, starting from A. Expand successors in alphabetical order, circle states that are expanded and avoid repeated states. What is the cost of your solution path?

(8 marks)

(ii) Consider the sentences given below.
1. Anything anyone eats is called food.
2. Amal likes all kinds of food.
3. Burger is a food.
4. Mango is a food.
5. Nimal eats pizza.
6. Nimal eats anything Amal eats.

a) Write the above sentences in predicate logic.

(6 marks)

b). Convert the above predicate logic expression into CNF. Hence prove that 'Amal likes Burger and Mango' using resolution.

(6 marks)

Q4

Consider the following scenario which is to be designed using an agent-based system and answer the questions.

The ABC Company employs a large number of employees all over the world. With the growth of the company the senior management finds it very difficult to recruit the correct person. This process has become more complicated due to global presence. Therefore the senior management wants to develop a methodology to test the candidates based on their individual profiles. Hence they decided to deploy a multi agent system for generating personalized question papers from an existing question bank.

Initially there needs to be a request to generate a personalized question paper. Then the profile of the candidate has to be examined. Accordingly a question has to be selected from the question bank based on several criteria such as the characteristic to be evaluated, education level, professional qualifications, working experience, hobbies etc. Then the selected question will be presented to the candidate and the question will be evaluated

and the second question will be selected by assessing whether the evaluation purpose is fulfilled or a re-adaptation is required.

i. Identify the agents necessary to design an agent based system for the above requirement.

(6 marks)

ii. What are the features that the agents in the proposed system need to have to perform the work required? (8 marks)

iii. Draw a block diagram to show the agent-based system you proposed. (6 marks)

Q5

Glass Identification data set was generated to help in criminological investigation. At the scene of the crime, the glass left can be used as evidence, but only if it is correctly identified. Out of the samples of glasses collected each sample glass can be classified into seven (07) types as follows; building_windows_float_processed, building_windows_non_float_processed,vehicle_windows_float_processed, vehicle_windows_non_float_processed (none in this database), containers, tableware and headlamps. There are 9 attributes associated with each type.

i. Describe the procedure of training the above data set using ANN to classify the seven (07) types of glass. (5 marks)

ii. Assuming that the available glass data set is small describe how you do the testing.

(4 marks)

iii. Describe how you improve the training error (sum errors) of a back propagation neural network. (5 marks)

iv. Compare and contrast supervised learning and unsupervised learning found in neural networks. (6 marks)

Q6

i. Describe what data mining is, giving real world examples. (4 marks)

ii. Compare and contrast
a). Discrimination and classification
b). Characterization and clustering (3×2=6 marks)

iii. Outliers are often discarded as noise. But in some situations they provide very valuable information. Describe such a real world scenario. (4 marks)

iv. OUSL is planning to provide information more efficiently to students. Hence the Information Technology division is planning to gather information from the OUSL website. Describe how you can gather useful information from the OUSL website using datamining techniques. (6 marks)

Q7

i. Briefly describe what is meant by a "fuzzy inference system". (3 marks)

ii. What is a linguistic variable? Give five (05) examples of linguistic variables that you can use to describe a university. (5 marks)

iii. Explain what is meant by defuzzification with an example. (3 marks)

iv. Explain why diversity is important when using genetic algorithms to solve problems. (3 marks)

v. Intelligent hybrid systems combine two, three AI systems such as expert systems, neural networks, genetic algorithms etc. to overcome any limitation in a single technique standalone system. Identify a scenario and describe how you can combine 2-3 intelligent systems to apply into the identified scenario. (6 marks)

End of Paper