MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2013/2014

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF MASTER OF SCIENCE IN COMPUTER SCIENCE

(CITY CAMPUS)

CAI 801: ESSENTIALS OF ARTIFICIAL INTELLIGENCE

Date: 26th July 2014   **Time:** 2.30 – 4.30 pm

INSTRUCTIONS:

- Attempt question ONE and any other TWO questions. (Question ONE carries a total of 30 marks and questions 2-5 have 20 marks.
- Uses of mobile phones are strictly forbidden.

Question one (Compulsory 30 marks)

A. Give the Strengths and weakness of production rules as a form of knowledge representation   (4 marks)

B. Differentiate between the following terms   (4 marks)
    i. Validity and soundness
    ii. Deductive and inductive reasoning

B. Represent the following sentences in predicate logic   (4 marks)
    i. All Kenyans are either loyal to Raila or hate him.
    ii. People only try to like people they are related to.

C. Explain the following agent types. Use pseudo codes to explain your answer
                                             (6 marks)

    i. Simple reflex agent
    ii. Table driven agent

D. Give the three mutation methods that used in genetic algorithms   (6 marks)

E. Explain the NN learning algorithm and Show that the below AND network gives the correct results   (6 marks)
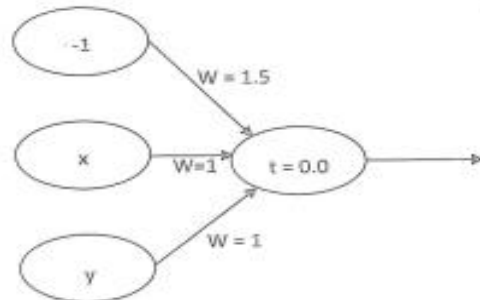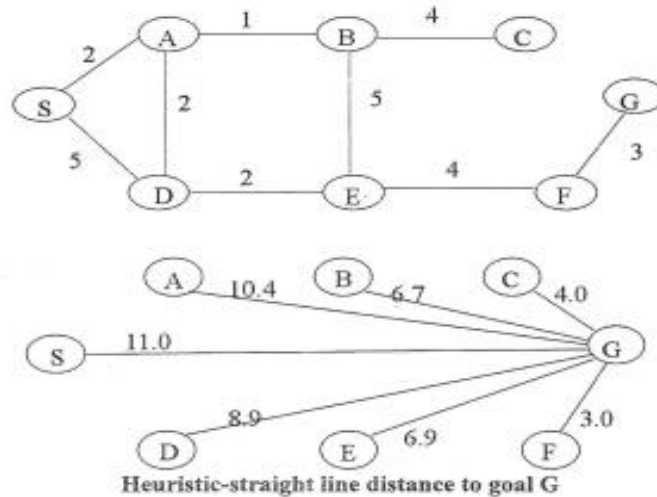

Question two (20 marks)

A. An aircraft emergency locator transmitter (ELT) is a device designed to transmit a signal in the case of a crash. The Altigauge Manufacturing Company makes 80% of the ELTs, the Bryant Company makes 15% of them, and the Chartair Company makes the other 5%. The ELTs made by Altigauge have a 4% rate of defects, the Bryant ELTs have a 6% rate of defects, and the Chartair ELTs have a 9% rate of defects (which helps to explain why Chartair has the lowest market share).

    i. If an ELT is randomly selected from the general population of all ELTs, find the probability that it was made by the Altigauge Manufacturing Company.
                                             (5 marks)

    ii. If a randomly selected ELT is then tested and is found to be defective, find the probability that it was made by the Altigauge Manufacturing Company.
                                             (5 marks)

B. Use the graph below to explain the below search strategies to find the best path from S (Start) to G (Goal).
  i.   A* Algorithm   (6 marks)
  ii. Greedy best first search   (4 marks)

Heuristic-straight line distance to goal G

Question three (20 marks)

A. Environments can be classified as Fully observable/Partially observable, Episodic/Sequential, Deterministic/Stochastic or Static/Dynamic. Explain each of the environment types   (8 marks)
   a. Fully observable/Partially observable
   b. Episodic/Sequential
   c. Deterministic/Stochastic
   d. Static/Dynamic

B. A semantic net represents knowledge by a structured approach. For instance, consider the following knowledge base:
Knowledge Base: A bird can fly with wings. A bird has wings. A bird has legs. A bird can walk with legs. Explain semantic net as a form of knowledge representation and give a semantic net representation of birds   (6 marks)

C. Consider the following knowledge base and database.

    Knowledge base:
    PR1: IF ((X is a man and Y is a woman) AND (X and Y are lovers)) THEN (X is a friend of Y).

PR2: IF ((X is a man and Y is a woman) AND (X married Y)) THEN (X loves Y).

PR3: IF ((X is a man and Y is a woman) AND (Y married X)) THEN (Y loves X).

PR4: IF ((X loves Y) AND (Y loves X)) THEN (X and Y are lovers).

Initial facts:

1. Ram is a man.
2. Sita is a woman.
3. Ram married Sita.
4. Sita married Ram.

Using backward chaining, show the sequence of selection of production rules to prove that "Ram is a friend of Sita". **(6 marks)**

Question four (20 marks)

A. Explain non-monotonic logic and explain the concept of closed world assumption as used in non-monotonic logic **(4 marks)**

B. In swarm intelligence, explain what happens under UpdatePheromones step **(4 marks)**

C. A knowledge base contains the below rules with associated conditional probabilities.

Prior probabilities

P (T-Typhoid) = 0.2, P (CP-Chicken Pox) = 0.5, P (GM-German Measles) = 0.3

Patient Symptoms: F- Fever, R- Rash, HBA – High Body Ache

Set of Rules

Rule 1: IF symptoms are F (P (F / T) = 0.9) AND HBA (P (HBA / T) = 0.6) THEN the Patient hopefully bears T.

Rule 2: IF symptoms are F (P(F/ GM) = 0.8) AND R (P (R / GM) = 0.7) AND HBA (P (HBA / GM) = 0.8) THEN the patient hopefully bears GM.

IF symptoms are F (P (F / CP) = 0.6) AND R (P (R/ CP) = 0.9) AND HBA (P (HBA / CP) =0.8) THEN the patient hopefully bears CP.

Compute the below probabilities

i.	P(CP/ R, F, HBR)	(3 marks)
ii.	P(T / F, HBA)	(3 marks)
iii.	P(GM /R, F, HBA)	(3 marks)
iv.	Given the patient symptoms, what disease is the patient most likely suffering from? Explain.	(3 marks)

Question five (20 marks)

A. Differentiate between crossover and mutation   **(4 marks)**
   i.   Crossover
   ii. Mutation

B. Give the pseudo code of an evolutionary algorithm   **(6 marks)**

C. The following, illustrates a basic "fuzzy" automatic conveyor system. The transmission uses 3 fuzzy inputs: mass index, weight and temperature.

   - "low mass index"

   A = {(0, 1), (1, 0.8), (2,0 .6), (3, 0.3), (4,0.2), (6, 0)}

   - "ok mass index"

   A = {(0, 0.2), (1, 0.4), (2, 0.5), (3, 0.6), (4, 0.3), (5, 0.2), (6, 0.1)}

   - "Low weight"

   {(2000,0 .8), (3000, 0.7), (4000, 0.6), (4500, 0.5), (6000, 0.4), (8000, 0.2), (10000, 0.1)}

   - "High weight"

   {(2000,0 .1), (3000, 0.3), (4000, 0.4), (4500,0. 5), (6000, 0.7), (8000, 0.8), (10000, 0.9)}

   - "low temperature"

   {(-10,1),(-6,1),(-3,1),(5,0.5),(10,0)}

   - "high temperature"

   {(5,0),(10,0.3),(15,0.5),(20,0.6),(25,0.8),(30,1)}

   i.   Perform the below fuzzy set operations
        1. Concentration on set "low number of children"   **(2 marks)**
        2. Dilation on set "cheap car"   **(2 marks)**
   ii. Plot the graphs for the three fuzzy inputs.   **(4 marks)**
   iii. The following rules were created to control the system.
        - If mass index is low and temperature is high then shift right
        - If temperature is low and mass index is ok and weight is low then shift forward
        - If mass index is ok and temperature is high and weight is high then shift backwards
   iv. What action will the automatic conveyor perform for the input: Mass index = 3.6, Temperature =18, Weight = 4700   **(2 marks)**