Code: AC74/AT74   Subject: ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS

AMIETE – CS/IT (NEW SCHEME)

Time: 3 Hours | JUNE 2012 | **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1   **Choose the correct or the best alternative in the following:**   **(2×10)**

a. The potential traps of Hill Climbing search algorithm are

   (A) Local maximum   **(B)** Plateau
   (C) Ridge   **(D)** All of these

b. Given $CF(h, O_1) = 0.5$, $CF(h, O_2) = 0.3$. The value of $CF(h, O_1 \wedge O_2)$ is

   (A) 0.65   **(B)** 0.8
   (C) 0.15   **(D)** None of these

c. Under what conditions, A* algorithm gives an optimal solution?

   (A) $h^*(n) > h(n)$ **(B)** $h^*(n) \le h(n)$
   (C) $g^*(n) \le g(n)$ **(D)** All of these

d. What must be generated as a result of resolving the following two clauses?
   loves(father(a), a) and ~loves(Y, X) $\vee$ loves(X, Y)

   (A) ~loves(a, father(a))   **(B)** ~loves(X, father(a))
   (C) loves(a, father(a))   **(D)** None of these

e. A pictorial representation of objects, their attributes and the relationship that exists between them is

   (A) Frame   **(B)** Semantic Net
   (C) Predicate Logic   **(D)** CD Formalism

f. Sigmoid function is so important and popular as an activation function in neural networks because it is

   (A) Bounded   **(B)** differentiable everywhere
   (C) Squeezing   **(D)** All of these

g. Prolog is

(A) Procedural Programming Language
(B) Declarative Programming Language
(C) Formula Programming Language
(D) All the above

h. What will happen with A* algorithm if $h*$ (estimated cost for goal node from current node) of each node is zero and the $g*$ (estimated cost for a node from starting node) is a constant.

(A) It is breadth first search.   (B) It is depth first search
(C) It is best first search   (D) It is Random search

i. Let A and B be two fuzzy sets given by
A = {x_1 , 0.2), (x_2 , 0.5), (x_3 , 0.6)}
B = {x_1 , 0.1), (x_2 , 0.4), (x_3 , 0.5)}
The membership value of x_2 in (A-B) is

(A) 0.2   (B) 0.5
(C) 0.4   (D) 0.6

j. Which of the following is a heuristics based searching technique

(A) Breath-first search   (B) Depth-first search
(C) Iterative deepening search   (D) Hill-climbing

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. List and discuss two potentially negative effects on society of the development of AI techniques. **(5)**

b. What is the difference between symbolic and non-symbolic representation? **(5)**

c. List main objectives of AI research. **(6)**

Q.3 a. Would you use breadth-first or depth-first search for each of the following problems? What would you base your choice on?
(i) A chess playing program.   (ii) A medical diagnostic program. **(6)**

b. Following are the rules to replace numerals 1 to 6

$6 \rightarrow 5, 1$ $5 \rightarrow 4, 1$ $4 \rightarrow 3, 1$ $3 \rightarrow 2,1$
$6 \rightarrow 4, 2$ $5 \rightarrow 3, 2$ $4 \rightarrow 2, 2$ $2 \rightarrow 1, 1$

Transform the numeral 6 into strings of 1's using AO^* algorithm. Assume that the cost of k connectors is k units and that the value of h function at node labeled by numerals 1 is 0 and at nodes labeled by x ($x \neq 1$) is x. Draw AND / OR tree. **(10)**

Q.4 a. Draw semantic network of the following sentence:
John gave a book to Mary.   **(4)**

b. Consider the pair of MYCIN rules:
   IF   (i)   The site of the culture is blood and
            (ii) The patient has ecthyma gangrenosum skin lesions
            THEN there is suggestive evidence (0.6) that the identity of the organism
            is pseudomonas
   IF   (i) The type of the infection is bacterial or
            (ii) The patient has been seriously burned
            THEN there is weakly suggestive evidence (0.4) that the identity of the
            organism is pseudomonas
   Suppose that the conditions of the first rule are satisfied with certainties 0.8 and
   0.9 respectively, while the conditions of the second rule are satisfied certainties
   0.2 and 0.3 respectively.
   According to Certainty Factor combination function, what certainty will be
   attributed to the conclusion that the identity of the organism is pseudomonas?
                                                                                                         (6)

c. Suppose that 'abnormal marks out of ten' is defined as the fuzzy set:
   f_{ABNORMAL} = { (0, 0.1), (1, 0.9), (2, 0.7), (3,0.5), (4, 0.3), (5,0.1),
            (6, 0.1), (7,0.3), (8, 0.5), (9, 0.9), (10, 0.9)}
   and 'high marks out of ten' is defined as the fuzzy set:
   f_{HIGH} = {(0, 0), (1, 0), (2, 0), (3,0.1), (4, 0.2), (5,0.3),
            (6, 0.4), (7,0.6), (8, 0.7), (9, 0.8), (10, 1.0)}
   Derive the composite function 'abnormally high marks out of ten'.   **(6)**

Q.5 a. Find the most general unifier of the following:
$P (a, x, f (g (y))), P (z, f (z), f (v))$.   **(4)**

b. Convert the following propositional calculus wff into clauses
$\neg[((P \vee \neg Q) \Rightarrow R) \Rightarrow (P \wedge R)]$ **(6)**

c. Consider the following knowledge base:
   The humidity is high and the sky is cloudy.
   If the sky is cloudy then it will rain.
   If the humidity is high then it is hot.
   It is not hot.
   And the goal: It will rain.
   Prove by resolution theorem that the goal is derivable from the knowledge base.
                                                                                                         (6)

Q.6 a. Show the conceptual dependency representation of the sentence:
Mala took the book from Madhu .   **(4)**

b. Describe a frame. Give an example and explain what is meant by a slot in a
frame.   **(6)**

   c. Create a script about shopping in a supermarket. **(6)**

Q.7 a. How does a neural network learn during supervised learning? **(4)**

   b. A neuron j receives inputs from two neurons whose activity levels are 0.6 and 0.5. The respective synaptic weights of j are –0.2 and 0.8. Calculate the output of the neuron if the neuron uses the threshold function as the activation function. Assume the threshold as 0.3. **(6)**

   c. Discuss the architecture of Expert System and explain its components. **(6)**

Q.8 a. Describe associative memory model proposed by Hopefield. Show different stable states of a Hopefield network. **(8)**

   b. Discuss benefits and limitations of Neural computing. **(8)**

Q.9   Write short notes on the following:

      (i)   AI in E-commerce
      (ii) Industrial Applications of AI
      (iii) Electronic-tourism domain
      (iv) HELP System. **(4×4)**