

AMIETE – CS/IT (OLD SCHEME)

Code: AC20/AT21

Subject: ARTIFICIAL INTELLIGENCE

NEURAL NETWORKS

Time: 3 Hours

DECEMBER 2010

Max. Marks: 100

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 half an hour 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. Goal-Driven search is
- (A) forward search (B) backward search
(C) random search (D) none of these
- b. The potential traps of Hill Climbing search algorithm are
- (A) Local maximum (B) Plateau
(C) Ridge (D) All of these
- c. 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
- d. Predicate Logic is
- (A) Non monotonic (B) Atomic
(C) Monotonic (D) None of these
- e. In game playing, alpha value of a node is
- (A) A lower bound on the value that a maximizing node be assigned
(B) An upper bound on the value that a minimizing node be assigned
(C) A upper bound on the value that a maximizing node be assigned
(D) An lower bound on the value that a minimizing node be assigned
- f. Prolog is
- (A) Procedural Programming Language
(B) Declarative Programming Language
(C) Formula Programming Language
(D) All the above

- g. What will happen with A* algorithm if h^* (estimated cost for goal 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
- h. Two fuzzy sets along with their truth-values are given below
 P: Mary is efficient (truth-value = 0.8).
 Q: Ram is efficient (truth-value = 0.65).
 Calculate the truth-value of the following:
 If Mary is efficient then so is Ram.
- (A) 0.65 (B) 0.8
 (C) 0.15 (D) None of these
- i. Learning new concepts or deriving new solutions through use of similar concepts and their solutions is
- (A) Rote Learning
 (B) Inductive Learning
 (C) Learning by Instruction or advice
 (D) Learning by Analogy
- j. Perceptron algorithm is suitable when the decision surface is
- (A) Linear (B) Non Linear
 (C) Any of these (D) None of these

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

- Q.2** a. If a problem-solving search program were to be written to solve each of the following types of problems, determine whether the search should proceed forward or backward:
- (i) water jug problem (ii) blocks world (8)
- b. Define admissibility and monotonicity of a heuristic. Does admissibility imply monotonicity of a heuristic? If not, can you describe when admissibility would imply monotonicity? (8)
- Q.3** a. Explain the effect of underestimation of the heuristic function in the A* algorithm with an example. (6)
- b. Define Soundness and completeness of a proof process. Prove that resolution theorem is sound and complete. (10)
- Q.4** a. Use resolution to prove $(q \Rightarrow \sim p) \Rightarrow ((q \Rightarrow p) \Rightarrow \sim q)$ (10)
- b. Draw semantic network of the following sentence
 Kavita gives a book to her friend. (6)

Q.5 a. The game nim is played as follows: Two players alternate in removing one, two or three pennies from a stack initially containing five pennies. The player who picks up the last penny loses. Show by drawing the game graph that the player who has the second move can always win. (8)

b. Show the conceptual dependency representation of the following sentence: John wanted Mary to go to the store. (8)

Q.6 a. Consider the evidence $e_1 = \text{single}$, $e_2 = \text{high income}$, $e_3 = \text{young}$, supporting the hypothesis $h_1 = \text{high-risk investor}$ or $h_2 = \text{low-risk investor}$, which are mutually exclusive and exhaustive. Assume that the domain expert estimates the posterior probabilities as:
 $P(h_1) = 0.3$, $P(h_2) = 0.7$, $P(e_1/h_1) = 0.6$, $P(e_1/h_2) = 0.3$, $P(e_2/h_1) = 0.2$,
 $P(e_2/h_2) = 0.8$, $P(e_3/h_1) = 0.5$, $P(e_3/h_2) = 0.2$.

Prove the following

- (i) If all three evidences are present then the investor is low-risk investor.
- (ii) If e_1 and e_3 are present then the investor is high-risk investor. (10)

b. Let A and B be two fuzzy sets given by
 $A = \{(x_1, 0.2), (x_2, 0.5), (x_3, 0.6)\}$
 $B = \{(x_1, 0.1), (x_2, 0.4), (x_3, 0.5)\}$
 Find $(A-B)^2$ (6)

Q.7 a. Write a Prolog program to split a list of Numbers into two lists: Positives including zero and Negatives.
 i.e. split (Numbers, Positives, Negatives).
 e.g. split ([3, 0, -9, 2, -3], [3, 0, 2], [-9, -3]) (8)

b. Write interactive and recursive prolog programs to find the sum of a list containing integer elements. (6)

c. What are advantages of using 'cut' in a prolog program? (2)

Q.8 a. Discuss the architecture of Expert System and explain briefly its various components. (5)

b. Consider the following context free grammar for English: (6)

- $S \rightarrow NP, VP$
- $NP \rightarrow N$
- $NP \rightarrow DET, N$
- $VP \rightarrow V, NP, PP$
- $VP \rightarrow V, PP$
- $PP \rightarrow PREP, NP$
- $DET \rightarrow ART$
- $DET \rightarrow ART, ADJ$

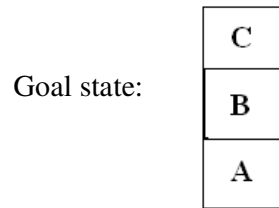
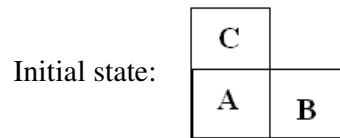
Check the validity of the following sentence with respect to given grammar.

Joe slept on the bed.

Also construct corresponding parse tree.

c. What is a supervised learning? How is it different from unsupervised learning? (5)

Q.9 a. Solve the following using linear planning:



- 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 , 0.8 and the bias is 0.02 . Calculate the output of the neuron if the neuron uses the sigmoid function as the activation function. (8)