Course Code : CST 311 / CST 323 **CXDW/RW – 18 / 5507**

Sixth Semester B. E. (Computer Science and Engineering) Examination

ARTIFICIAL INTELLIGENCE

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) Solve any **Two** sub questions from each question.
(3) All the sub questions in question no. **One** are compulsory.
(4) All questions carry marks as indicated.
(5) Explain your answer with neat sketches, wherever applicable.

1. (a) Consider the 3 – water jug problem, which is stated as follows : There are three jugs of capacity 8, 5 and 3 liters. There is no mark on any jug. Initially the 8-liter jug is filled with water and other two jugs are empty. You cannot get water from any external source and you cannot pour water on the ground. How to get 4 liter of water in 8-liter jug. Determine operators (rules) for 3-water-jug problem. 5 (CO 1)

   (b) Analyze the Chess problem w.r.t. seven problem characteristics. 5 (CO 1)

2. (a) Analyze the Breadth first Search, Depth first Search and best first w.r.t. Time Complexity, Space Complexity, Completeness and Optimality. 5 (CO 2)

   (b) Solve the 8-puzzle problem by using A* algorithm up to 3 iterations. Assume suitable initial and goal state. 5 (CO 2)

   (c) Explain the drawbacks of the Hill Climbing algorithms. Also propose the possible remedies over them. 5 (CO 2)

3 (a) Convert the following sentences in to first order predicate logic :

   (1) Some children will eat any food.

(2) No children will eat food that is green.

(3) All children will like food made by Cadbury's.

And prove that "No food made by Cadbury's is green ." By resolution. 5 (CO 3)

(b) Write the steps to convert the predicates in to clause form. 5 (CO 3)

(c) Construct the partitioned semantic network for the following facts:

(i) Every Dog has bitten the mail carrier

(ii) Every Dog has bitten a mail carrier. 5 (CO 3)

4. (a) We have a bag of three biased coins a, b, and c with probabilities of coming up heads of 20%, 60% and 80%, respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins), and then the coin is flipped three times to generate the outcomes X1, X2, and X3.

(a) Draw the Bayesian network corresponding to this setup and define the necessary CPTs.

(b) Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once. 5 (CO 4)

(b) Consider a medical diagnosis problem in which there are two alternative hypotheses. The patient has a particular form of cancer (denoted by cancer). The patient does not (denoted by $\neg$cancer). The available data is from a particular laboratory with two possible outcomes: $\oplus$ (positive) and $\ominus$ (negative)

P(cancer) = .008	P($\neg$cancer) = 0.992
P($\oplus$|cancer) = .98	P($\ominus$|cancer) = .02
P($\oplus$|$\neg$cancer) = .03	P($\ominus$|$\neg$cancer) = .97

Suppose a new patient is observed for whom the lab test returns a positive ($\oplus$) result.

Should we diagnose the patient as having cancer or not ? Use Bayes formula to compute the result. 5 (CO 4)

(c) Consider the following real variables from everyday life :

- Income measured in $ UK.
- Speed measured in meters per second.
- A TV show measured in how much you are interested watching it.
- A meal measured in how much you like to eat it.
- A traffic light measured in what colour is on.

In each case, suggest a fuzzy variable corresponding to these real variables. For which of these five variables the use of a fuzzy variable is not really necessary ? Why ? 5 (CO 4)

5. (a) Design a three input perceptron that implements Boolean function A $\wedge$ B. 5 (CO 5)

(b) Construct decision trees to represent the following Boolean functions :

(i) A OR [B AND C]

(ii) [A AND B] OR [C AND D] 5 (CO 5)

(c) Apply Inductive learning to solve Curve fitting. 5 (CO 5)

6. (a) With the help of a neat sketch explain components of a typical expert. System. 5 (CO 6)

(b) Provide the details about following expert systems :

(1) MYCIN

(2) DENDRAL 5 (CO 6)

(c) List the main players involved in expert system development and explain. 5 (CO 6)