Course Code : CST 311 **ITSJ/RW – 17 / 1346**

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) All questions carry marks as indicated.
(3) Internal choices are given for some questions.
(4) Explain your answer with neat sketches, wherever applicable.

1. (a) The missionaries and cannibals problem is usually stated as follows. Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side, without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place :

   (i) Formulate this problem as search : i.e. give a state space representation, start state, goal state and operators.

   (ii) Draw the search tree and show the final solution. 7 (CO 2)

   (b) Classify travelling salesperson problem, water jug problem with respect to seven problem characteristics. 3 (CO 1)

2. (a) Give the initial state, goal test, successor function (operators) and cost function (path cost) for each of the following :—

   (i) You have to color a planar map using only four colors, in such a way that no two adjacent regions have the same color.

   (ii) A 3 – foot – tall monkey is in a room where some bananas are suspended from the 8 – foot ceiling. He would like to get the bananas. The room contains two stackable, movable, climbable 3 – foot – high crates. 6 (CO 2)

(b) Summaries the A* algorithm and explain it with 8 – puzzle problem up to 3 iterations. 4 (CO 2)

3. (a) Consider the following set of facts :

(1) Everyone who loves all animals is loved by someone.

(2) Anyone who kills an animal is loved by no one.

(3) Jack loves all animals.

(4) Either Jack or curiosity killed the cat, who is named Tuna.

Solve the following :—

(a) Represent these fact using predicate logic.

(b) Convert all these facts into clause form.

(c) Answer the question "Did Curiosity kill the cat ?" 7 (CO 3)

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

(i) Rajeev give a book to Shweta.

(ii) Every batter hits a ball. 3 (CO 3)

4. (a) After your yearly checkup, the doctor has bad news and good news. The bad news is that you tested positive for a serious disease and that the test is 99% accurate (i.e., the probability of testing positive when you do have the disease is 0.99, as is the probability of testing negative when you don't have the disease). The good news is that this is a rare disease, striking only 1 in 10,000 people of your age. Why is it good news that the disease is rare ? Determine the chances that you actually have the disease. 6 (CO 4)

OR

How the basic operations like Union, Intersection and set difference are defined in terms of membership function on the fuzzy sets ? Explain with an example. 6 (CO 4)

(b) You have a new burglar alarm installed at home. It is fairly reliable at detecting a burglary, but also responds on occasion to minor earthquakes. (This example is due to Judea Pearl, a resident of Los Angeles – hence the acute interest in earthquakes.) You also have two neighbors, John and Mary, who have promised to call you at work when they hear the alarm. John always calls when he hears the alarm, but sometimes confuses the telephone ringing with the alarm and calls then, too. Mary, on the other hand, likes rather loud music and sometimes misses the alarm altogether.

(i) Draw the Bayesian network for this event.

(ii) Determine $P(j \wedge m \wedge a \wedge \sim b \wedge \sim e)$. Consider any suitable values in conditional probability tables. 4 (CO 1)

5. Solve any **Two** :—

(a) Construct a neural network that computes the OR function of three inputs. Make sure to specify what sort of units you are using. 5 (CO 5)

(b) Summaries the Decision Tree algorithm with an example. 5 (CO 5)

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

6. Solve any **Two** :—

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

(b) Consider the knowledge base given as :

$Y \ \& \ D \longrightarrow Z$

$X \ \& \ B \ \& \ E \longrightarrow Y$

$A \longrightarrow X$

$C \longrightarrow L$

$L \ \& \ M \longrightarrow N$

And the contents in the database are A, B, C, D, E.

Prove that 'Z' is true by using forward and backward chaining. Also List down the difference between forward and backward chaining. 5 (CO 5)

(c) Provide the details about following expert systems :—

(1) PROSPECTOR.

(2) DENDRAL. 5 (CO 5)