Computer Engineering Department, S. V. N. I. T., surat

B. Tech III (CO), 5th Semester

End semester Examination, Nov-Dec 2018

Subject : Artificial Intelligence and Machine Learning (CO305)

Date :29th Nov 2018 Time 12:00 to 15:00 hrs Marks : 100

Instructions:

- Figures in the right indicates marks
- The Tables and Figures reffered in the questions are given in the Datasheet in the question paper
- Support your answers with suitable diagrams whenever necessary
- Assume suitable data whenever necessary

Q. 1 Answer Following questions [Any Five] [50]

1. CART algorithm use Gini Index to create the classification tree. Write the algorithm for CART creation procedure and Create the Root node of the tree using data in Table 1.
2. How continuous valued attribute is managed in C4.5 Algorithm? Write the algorithm for the same and demonstrate the process for data in Table 2 (considering the splitting point 65 and 70) Which one of them is a batter splitting point?
3. What is a major difference between K-means and K-Medoid clustering algorithm? Perform K-Medoid algorithm for the data in Table 3, for k=2 with C1= (3,4) and c2= (7,4). Use Manhattan distance measure.
4. i. What the confusion matrix is and why you need to use it.
   ii. Define F-Score measure to evaluate the result of an algorithm.
   iii. What are the limitations of accuracy measure which create the need of F-score measure?
   iv. Calculate Accuracy, Error Rate and F-Score measure for confusion matrix for the binary classifier given in **Table 4**.
5. Explain Discretization as a pre-processing task of machine learning. What is static discretization? Explain any two static discretization techniques with suitable example.
6. i. Discuss the role of activation function in Neural Network.
   ii. Enlist and explain the different activation functions of Neural Network.
   iii. Construct by hand a neural network that computes the given below functions of two inputs. (Clearly mentation all necessary assumptions such as initial weight, bias, activation function, etc. also perform at least two epochs)

   1)AND 2) OR
7. i. List and explain different cost functions for Logistic Regression with advantages and dis-advantages
   ii. List and explain parameter estimation methods for Logistic Regression.
   iii. Compare and contrast Linear regression and Logistic regression.

Q.2 Answer following questions (Any Five) [50]

1. Define Expert system. Explain working of ES with block diagram. How does working of MYCIN - an expert system, fits in this block diagram?
2. For the given root map in **Figure 1** considering A (Arad) as a start state and B (Bucharest) as a goal state help the traveller to find the path between these two cities using BFS and UCS
3. Draw the state space for the 4 Queen problem. Demonstrate the use of backtracking to solving the puzzle.
4. There are just two rooms and the robot can be in either room. There can be dirt in zero, one, or two rooms. And Robot can move Left or Right to choose the room and then clean. How will you define the statespace with all possible transition/action? Show the single state statespace for the given problem from both the rooms are dirty to both the rooms are clean.
5. Consider the following game tree of **Figure 2**. Assume that the children of each node are evaluated from left to right.
   i. Use the Minimax to compute the value of each node in the game tree.
   ii. List the nodes that are evaluated by Alpha-Beta.
   iii. Redraw the game tree such that Alpha-Beta performs the minimum number of evaluations (i.e., the best case for Alpha-Beta). How many nodes are evaluated by Alpha Beta in the resulting game tree?
   iv. Redraw the game tree such that Alpha-Beta performs the maximum number of evaluations (i.e., the worst case for Alpha-Beta). How many nodes are evaluated by Alpha-Beta in the resulting game tree?
6. Consider the following sentences:
   a) John likes all kinds of food
   b) Apples are food . Chicken is food
   c) Anything anyone eats and isn't killed by is food
   d) Bill eats peanuts and is still alive
   e) Sue eats everything Bill eats.

   Part-a: Translate these sentences into formulas in predicate logic.

   Part-b: Convert the formulas of Part-a into clause form.
7. Consider the graph given in **Figure 3**.
   i. Write the membership functions corresponding to the fuzzy sets. Hence answer the question: How cool is 36°F?
   ii. Explain the methods of defuzzification.
   iii. Elaborate on Fuzzy Inference Systems.

Computer Engineering Department, S V N I T, Surat.
Supplementary Examination, Feb 2020
B.Tech.-III – Fifth Semester
Course: Artificial Intelligence and Machine Learning (CO-305)

Date: 10 Dec 2020 Time: 10:00 to 01:00 Max Marks: 100

Instructions:
1. Write your B.Tech. Admission No/Roll No and other details clearly on the answer books while writing your B.Tech. Admission No on the question paper, too.
2. Assume and write necessary data with proper justifications, if any.
3. Be precise and clear in answering the questions.
4. Support your answer with the necessary diagrams and examples.

Q.1 Answer the following. (Any five) [50]

1) Consider dataset that describes the weather conditions for playing a game of golf. Given the weather conditions, each tuple classifies the conditions as fit ("Yes") or unfit ("No") for plaing golf. use **naive bayes classifier** to find probability that a player can play golf or not , given today's weather (i.e. Sunny, Hot, Normal, False) find probability P(Yes|Sunny, Hot, Normal, False) and P(No|Sunny, Hot, Normal, False)

	OUTLOOK	TEMPERATURE	HUMIDITY	WINDY	PLAY GOLF
0	Rainy	Hot	High	False	No
1	Rainy	Hot	High	True	No
2	Overcast	Hot	High	False	Yes
3	Sunny	Mild	High	False	Yes
4	Sunny	Cool	Normal	False	Yes
5	Sunny	Cool	Normal	True	No
6	overcast	Cool	Normal	True	Yes
7	Rainy	Mild	High	False	No
8	Rainy	Cool	Normal	False	Yes
9	Sunny	Mild	Normal	False	Yes
10	Rainy	Mild	Normal	True	Yes
11	overcast	Mild	High	True	Yes
12	overcast	Hot	Normal	False	Yes
13	Sunny	Mild	High	True	No

2) Construct by hand a neural network that computes the given below functions of two inputs. (Clearly mentation all necessary assumptions such as initial weight, bias, activation function, etc. also perform at least three epochs)

3) 1. OR 2.AND

"As per the law, it is a crime for an American to sell weapons to hostile nations. Country A, an enemy of America, has some missiles, and all the missiles were sold to it by Robert, who is an American citizen."
Prove that **"Robert is criminal." (Use Forward Chaining)**

4) Answer following Questions.
   a) State difference between PCA and LDA.
   b) What is "curse of dimensionality" and how to deal with it?
   c) Difference between K-Means and K-Medoids.

5) The 8 puzzle consists of eight numbered, movable tiles set in a 3x3 frame. One cell of the frame is always empty thus making it possible to move an adjacent numbered tile into the empty cell. Draw a complete search tree for given Start and Goal state, up to depth level 3 (where Start state is at depth 0) and give unique ID to each node of the tree.
Give the Node Traversal sequence for the following search approaches

a) Brute-Force Approach
b) Depth-First Search (DFS)
c) Depth-First Iterative Deepening (DFID) Search

Hill Climbing (where heuristic function h = number of tiles that are not in the correct place (not counting the blank))

Start state

1	2	3
4	8	5
7	6	

Goal state

1	2	3
	8	5
4	7	6

Also comment on the performance of all the search techniques.

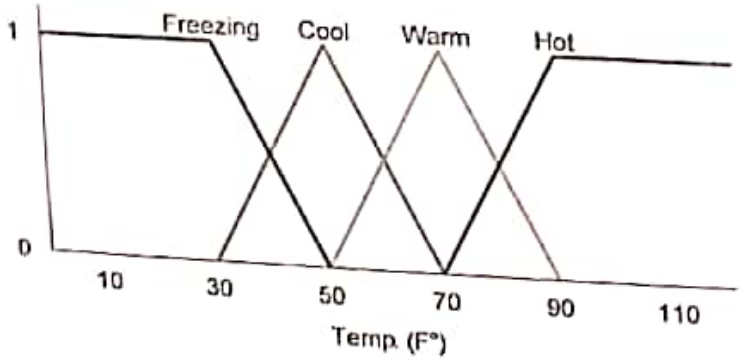
6) Explain Expert System with proper block diagram. Describe each block the of an Expert System. Explain working of each blocks for MYCIN- an expert system.

Q.2 Answer the following. (Any five) [50]

1) Convert the following sentences in to predicate logic to design the knowledge base.
   a) Every person loves themself.
   b) Everyone loves some person who loves themself.
   c) All gardeners like the sun.
   d) Some person loves no one except themself.
   e) Toby loves everyone who loves him.
   f) Love is never requited. (Expand out the meaning of requited.)
   g) Brown frogs are bigger than green frogs.
   h) No natural food is blue.
   i) Mary gave an apple to Tom.
   j) One of the apples that Mary gave to Tom is Rotten.

2) Consider the graph given in Figure.
   i. Write the membership functions corresponding to the fuzzy sets. Hence answer the question: How cool is 36°F?
   ii. Explain the methods of defuzzification.

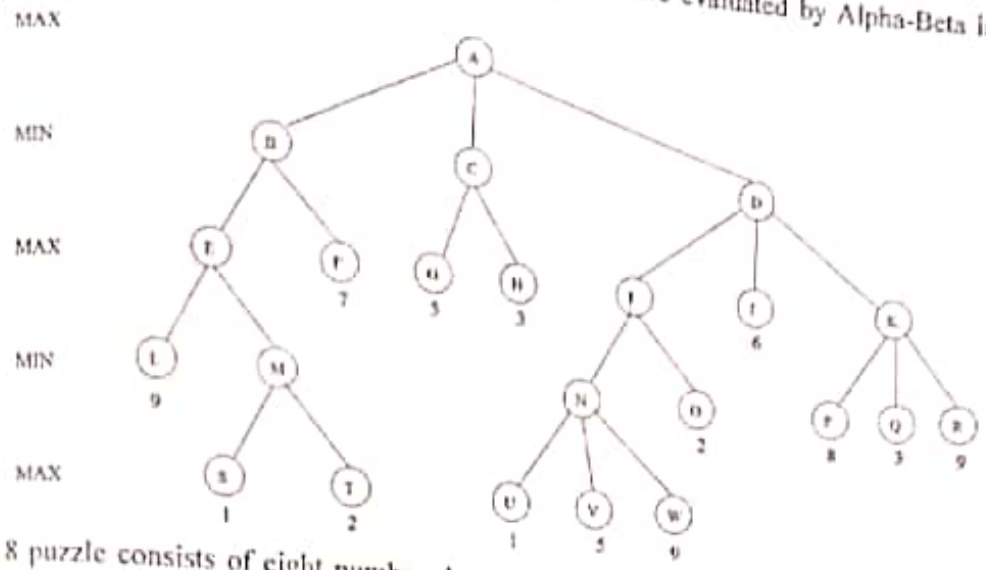
   Elaborate on Fuzzy Inference Systems



3) Consider the following game tree of given figure. Assume that the children of each node are evaluated from left to right.
   i. Use the Minimax to compute the value of each node in the game tree.
   ii. List the nodes that are evaluated by Alpha-Beta.
   iii. Redraw the game tree such that Alpha-Beta performs the minimum number of evaluations (i.e., the best case for Alpha-Beta). How many nodes are evaluated by Alpha Beta in the resulting game tree?

   Redraw the game tree such that Alpha-Beta performs the maximum number of evaluations

(i.e., the worst case for Alpha-Beta). How many nodes are evaluated by Alpha-Beta in the resulting game tree?



4) The 8 puzzle consists of eight numbered, movable tiles set in a 3x3 frame. One cell of the frame is always empty thus making it possible to move an adjacent numbered tile into the empty cell. Draw a complete search tree for given Start and Goal state, up to depth level 3 (where Start state is at depth 0) and give unique ID to each node of the tree.

1. Give the Node Traversal sequence for 1) Best First Search and 2) A* for the following Heuristics search approaches

   a. Heuristic search using the heuristic function h = number of tiles that are not in the correct place (not counting the blank).
   b. Heuristic search using the Manhattan heuristic function.

Start state

1	2	3
4	8	5
7	6	

Goal state

1	2	3
	8	5
4	7	6

5) Consider the following data set consisting of the scores of two subjects on each of seven individuals cluster individuals into two different clusters Using K-means Clustering.

Subject	A	B
1	1.0	1.0
2	1.5	2.0
3	3.0	4.0
4	5.0	7.0
5	3.5	5.0
6	4.5	5.0
7	3.5	4.5

6) Explain Filter methods and Wrapper Methods.

Computer Engineering Department, S V N I T, Surat.

End-Semester Examination, December 2019

B.Tech.-III – Fifth Semester

Course: Artificial Intelligence and Machine Learning (CO-305)

Date: 4 Dec 2019 Time: 12:00 to 03:00 Max Marks: 100

Instructions:

1. Write your B.Tech. Admission No/Roll No and other details clearly on the answer books while writing your B.Tech. Admission No on the question paper, too.
2. Assume and write necessary data with proper justifications, if any.
3. Be precise and clear in answering the questions.
4. Support your answer with the necessary diagrams and examples.

Q.1 Answer the following. (Any two) [24]

1) A, B and C belong to the Himalayan club. Every member in the club is either a mountain climber or a skier or both. A likes whatever B dislikes and dislikes whatever B likes. A likes rain and snow. No mountain climber likes rain. Every skier likes snow.
Q1: Is there a member who is a mountain climber and not a skier?
   - Define the Facts and Rules
   - Draw the states space to solve the Query Q1

2) The puzzle consists of 8 tiles and one empty space in the form of 3 X 3 matrix. The tiles can be moved into the empty space only one tile and one step at a time.
   - Define two different heuristics for the given Puzzle [2]
   - Draw the most suitable heuristic based search space tree to reach the goal state from the initial state given below [8]
   - Which heuristic will provide optimal solution for the given states [2]

Initial State

1	2	3
8		4
7	6	5

Goal State

2	8	1
	4	3
7	6	5

3) Tic-Tac-Toe is a famous board game where it is X's turn to play next. The current state is shown in the figure.

X	O	X
O		O
	X	

Evaluation function :
$Eval(s) = 10X_3(s) + 3X_2(s) + X_1(s) - (10O_3(s) + 3O_2(s) + O_1(s))$ Where
$Xn(s)$ = number of rows, columns, or diagonals in state s, with exactly n X's and no O's
$On(s)$ = number of rows, columns, or diagonals in state s, with exactly n O's and no X's
   - Show the entire game tree with a mark of the utility of each terminal state
   - Use the Min-Max algorithm to calculate the optimal move

Q.2 Answer Following. (Any Four) [24]

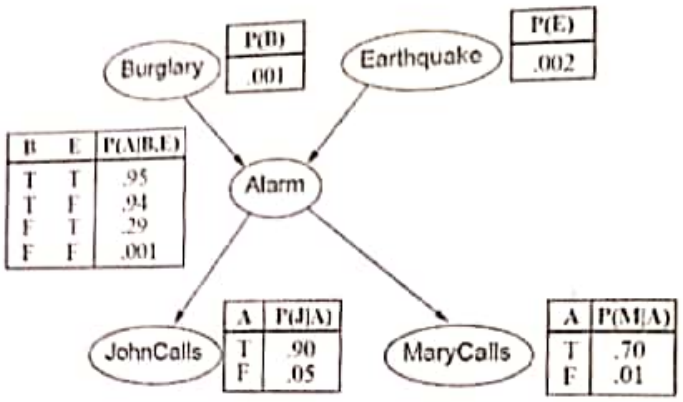
1) List major disadvantages of Hill Climbing Technique and propose solution for these problems with suitable example.
2) List Major difference between Forward chaining and Backward chaining
3) Draw Block diagram of Fuzzy Expert System and explain each block with suitable example.
4) What is the importance of planning in AI problem solving? List Important steps of planning and define Goal stack planning.
5) "One particularly simple form of semantic network is an AND/OR Tree" Justify the statement and support your answer with proper example.

Q.3 Answer Following. (Any Four)

1) What is Bayes nets? Give Advantages and disadvantages of Bayes nets. Consider below given burglar alarm system and corresponding conditional probability table. Answer following

(1) $P(J \wedge M \wedge A \wedge \neg B \wedge \neg E) = ?$

(2) $P(J) = ?$



2) Define following with respect to Performance evaluation.
   a. Precision vs Recall
   b. True Error vs Sample Error
   c. Confusion matrix.

3) We have data from questionnaires survey (to ask people opinion) and objective testing with two attributes (Acid durability and strength) to classify whether a special paper tissue is good or not. Here is four training examples given below. Now factory produces a new paper tissue that passes laboratory test with x1=3 and x2=7.
Without another expensive survey, can we guess what the classification of this new tissue is?
Use 3NN algorithm to solve this.

Sr.no	Acid durability (X1 seconds)	Strength (X2 kg/square meter)	Classifiction (Y)
1	7	7	Bad
2	7	4	Bad
3	3	4	Good
4	1	4	Good

4) List and Explain different types of Artificial neural networks.

5) Explain Linear and Non Linear SVM.

Q.4 Answer Following. (Any Four)

1) What is Back propagation? Explain Back propagation training algorithm with the help of one hidden layer feed forward Neural network.

2) What is Neural learning? Construct a Neural network that computes XOR function and NOR Function for two inputs (Mention all necessary assumptions such as initial weights bias, activation function, etc.)

3) What is Ensemble learning? Discuss Bagging and boosting.

4) Compare Linear regression and Logistic regression. Explain Linear regression with appropriate example.

5) What are the two types of feature reduction? Explain feature selection methods.

Computer Engineering Department, S V N I T, Surat.

Mid-Semester Examination, October 2019

B.Tech.-III – Fifth Semester

Course: Artificial Intelligence and Machine Learning (CO-305)

Date: 3rd Oct 2019 Time: 02:00 to 03:30 Max Marks: 30

Instructions:

1. Write your B.Tech. Admission No/Roll No and other details clearly on the answer books while writing your B.Tech. Admission No on the question paper, too.
2. Assume and write necessary data with proper justifications, if any.
3. Be precise and clear in answering the questions.
4. Support your answer with the necessary diagrams and examples.

Q-1 Answer the following. **[12]**

(1) "The state space representation forms the basis of most of the AI methods for problem solving" Justify this statement using Water Jug Problem as described below, showing multiple sequence of solution.

Water Jug Problem: Given two jugs, a 4-gallon one and 3-gallon one. Neither has any measuring marked on it. There is a pump, which can be used to fill the jugs with water. How can we get exactly 2 gallons of water into 4-gallon jug?

(2) Using Block Diagram Explain the Utility based Intelligent Agent for the "Smart Automatic Taxi Driver

(3) Write First Order Predicate Logic for the following English Statement

a. John does not love anyone (involving negation and the existential quantifier)

b. Someone walks and talks.

d. Someone walks and someone talks

e. Anyone who loves everyone loves himself.

Q-2 Answer the following. [Any three] **[18]**

(1) State difference between PCA and LDA and answer following. Company "AMD" produces expensive high quality chip rings. Their quality is measured in term of curvature and diameter. Result of quality control experts is given in the table below. Find the axes (direction of projection) that maximize the separation between the rings that have passed the quality control test and the rings that have not passed the quality control test in order to predict test result for future production using Discriminant analysis.

Curvature	4	2	2	3	4	9	6	9	8	10
Diameter	1	4	3	6	4	10	8	5	7	8
Quality Control result	Passed	Passed	Passed	Passed	Passed	Not Passed	Not Passed	Not Passed	Not Passed	Not Passed

(2) Consider dataset where we have features of a car and data that particular car is stolen or not. Use **Naive Bayes classifier** to find probability that a car is stolen or not, given car feature (i.e. Red Domestic SUV). find probability P(Yes| Red, Domestic, SUV) and P(No| Red, Domestic, SUV)

Sr. No.	Color	Type	Origin	Stolen?
1	Red	Sports	Domestic	Yes
2	Red	Sports	Domestic	No
3	Red	Sports	Domestic	Yes
4	Yellow	Sports	Domestic	No
5	Yellow	Sports	Imported	Yes
6	Yellow	SUV	Imported	No
7	Yellow	SUV	Imported	Yes
8	Yellow	SUV	Domestic	No
9	Red	SUV	Imported	No
10	Red	Sports	Imported	Yes

(3) Write an algorithm to design a tree based classification model based on the given historical data, to predict the characteristic of dog for the unknown data. Following your algorithm, derive the root node of the classification tree.

Sr. No.	Colour	Body Size	Hair Type	characteristic
1	black	big	Poodle	danger
2	black	big	smooth	danger
3	brown	big	Poodle	safe
4	white	medium	Poodle	safe
5	white	small	Poodle	safe
6	white	small	smooth	danger
7	brown	small	smooth	safe
8	black	medium	Poodle	danger
9	black	small	Poodle	safe
10	white	medium	Poodle	safe
11	black	medium	smooth	safe
12	brown	medium	smooth	safe
13	brown	big	Poodle	safe
14	white	medium	smooth	danger

(4) State Difference between K-Means and K-Medoids algorithms, and solve following clustering problem with an appropriate clustering algorithm.

Suppose we have several medicines with their weight index and pH value. Cluster medicine into two different groups based on data given below in order to minimize total squared error.

Medicine	Cefadroxil	Cetrizine	domperidone	Peracetamol	Crocin 650
Weight index	1.29	2.08	4.53	5.67	2.38
pH	1	1	3	4	4