Q. P. Code: 24610

3 Hours   Total Marks = 80

Dec - 17

Note:
  (i) Each question carries 20 marks
  (ii) Question 1 is compulsory
  (iii) Attempt any three (3) from the remaining questions
  (iv) Assume suitable data wherever required

Q1. Attempt any four (4) questions from the following: [20]
  (a) Give PEAS description for an Autonomous Mars Rover. Characterize its environment.
  (b) Give the initial state, goal test, successor function, and cost function for the following problem
    "You have to colour a planar map using only 4 colours, in such a way that no two adjacent regions have the same colour".
  (c) Draw and explain architecture of Expert System.
  (d) Explain Hill-climbing algorithm with an example.
  (e) Covert the following propositional logic statement into CNF
    (i) $A \rightarrow (B \leftrightarrow C)$

Q2. (a). Explain decision tree learning with an example.   [10]

(b) Write first order logic statements for following statements: [10]
    (i)   Horses, cows, and pigs are mammals.
    (ii)   Bluebird is a horse.
    (iii)   Whoever can read is literate.
    (iv)   Every tree in which any aquatic bird sleeps is beside some lake.
    (v)   Anything anyone eats and is not killed by is food.

Q3. (a) Design a planning agent for a Blocks World problem. Assume suitable initial state and final state for the problem.   [10]

  (b) Consider a situation in which we want to reason about the relationship between smoking and lung cancer. Intuitively, we know that whether or not a person has cancer is directly influenced by whether she is exposed to second-hand smoke and whether she smokes. Both of these things are affected by whether her parents smoke. Cancer reduces a person's life expectancy.
    (i) Draw the Bayesian network.
    (ii) How many independent values are required to specify all the conditional probability tables (CPTs) for your network?   [10]

Q4. (a) Compare **Greedy Best first search** and **A* search** algorithms based on performance measure with justification: Complete, Optimal, Time and Space complexity.   [10]
  (b) Write a pseudocode for alpha-beta algorithm. Apply alpha-beta pruning on example given in Figure 1 considering first node as max.   [4+6]

01, 02, 04, 05, 06, 07, 08,
11, 12, 13, 14, (15), (18)
19, 20, 21, 22, 23
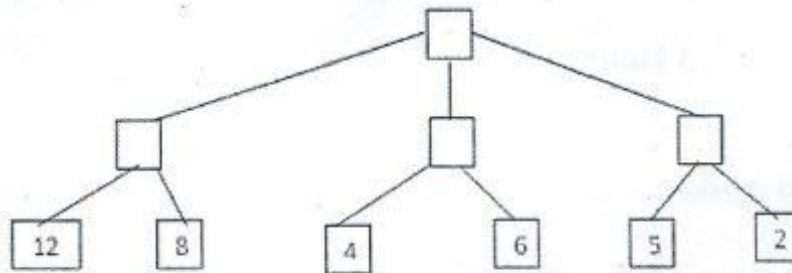
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Figure 1.

Q5. (a) Define the terms chromosome, fitness function, crossover and mutation as used in Genetic algorithms. Explain how Genetic algorithms work? [4+6]

(b) Consider the graph given in Figure 2 below. Assume that the initial state is A and the goal state is G. Show how **Greedy Best first Search** would create a search tree to find a path from the initial state to the goal state: [10]
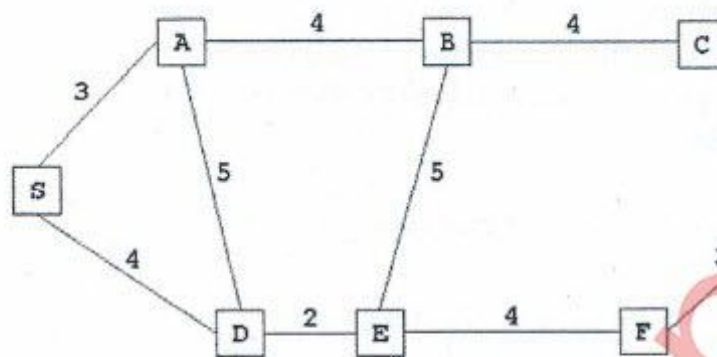

Figure 2.

At each step of the search algorithm, show which node is being expanded, and the content of fringe. Also report the eventual solution found by the algorithm, and the solution cost. Assuming the straight-line distance as the heuristics function: h(S)=10.5, h(A)=10, h(B)=6, h(C)=4, h(D)=8, h(E)=6.5, h(F)=3 and h(G)=0.

Q6. Answer any two (2) of the following [20]
 (i)   What are steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence.
 (ii)   Draw and explain the basic building blocks of Learning Agent.
 (iii)   How will you convert the propositional logic statement into CNF? Give a suitable example at each step.

Q. P. Code: 24612

May - 18

(3 Hours)

[Total Marks: 80]

Note:

(i) Each question carries 20 marks
(ii) Question 1 is compulsory
(iii) Attempt any three (3) from the remaining questions
(iv) Assume suitable data wherever required

Q.1. Attempt any four (4) questions from the following. [20]
a) Define Intelligent Agent. What are the characteristics of Intelligent Agent?
b) Give State space representation for 8 puzzle Problem. What are possible Heuristic functions for it?
c) What is FOPL? Represent the following sentences using FOPL
   i) John has at least two friends
   ii) If two people are friends then they are not enemies.
d) Differentiate between forward and backward chaining.
e) Define Belief Network. Explain conditional Independence relation in Belief Network with example.

Q.2 a) Draw and Describe the Architecture of Utility based agent. How is it different from Model based agent? [10]

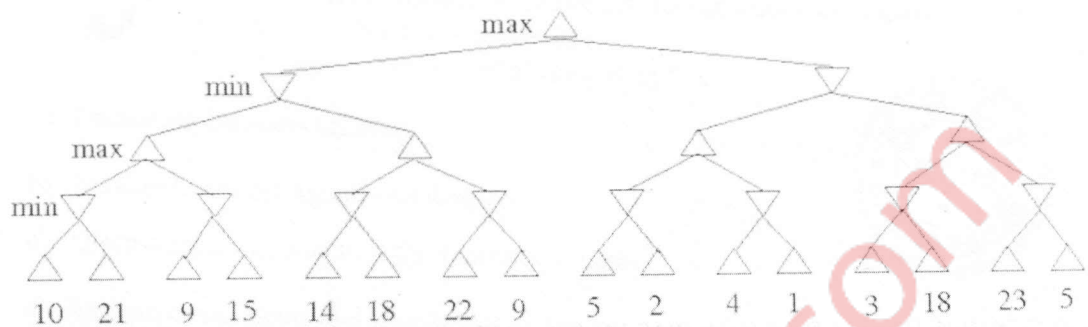b) Explain A* Algorithm with example. [10]

Q.3 a) Explain Resolution by Refutation with suitable example [10]

b) Give the partial order plan for the following blocks-world-problem [10]

Start State   Goal State

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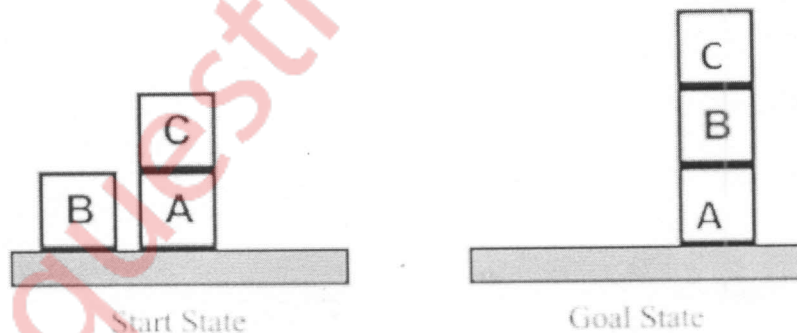
Q.4   a) Apply Alpha-Beta pruning on following example considering first node as MAX   [10]

b) Explain different Inference Rules for First Order Predicate Logic.   [10]

Q.5 a) Define the terms chromosome, fitness function, crossover and mutation as used in
Genetic algorithms. Explain how Genetic algorithms work.   [10]

b) What are steps involved in natural language processing (NLP) of an English sentence?
Explain with an example sentence.   [10]

Q. 6 Write short note on any two of the following   [20]
   a) Expert System Architecture and Applications
   b) Local Search Algorithms
   c) Decision Tree learning

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3 Hours

Dec - 18

Total Marks = 80

Note:
- (i) Each question carries 20 marks
- (ii) Question 1 is compulsory
- (iii) Attempt **any three (3)** from the remaining questions
- (iv) Assume suitable data wherever required

Q1   Attempt **any four (4)** questions from the following   [20]

- (a) Give PEAS description for a **Self Driving Car** agent. Characterize its environment.
- (b) Give the initial state, goal test, successor function, and cost function for the **Travelling salesman problem**
- (c) What will be the job of each of the components (Performance element, Learning element, Critic and problem generator) of learning agent?
- (d) Consider an 8 puzzle problem with the following initial state and goal state.

7	2	4
5		6
8	3	1

Initial State

	1	2
3	4	5
6	7	8

Goal State

Generate successors at next two levels. Apply number of misplaced tiles as the heuristic function. Which successor nodes will be selected at each level if we apply Hill climbing algorithm?

- (e) Convert the following English sentence into predicate logic and then into CNF
  "The culprit was tall and dark"

Q2 (a) Explain decision tree learning with an example. What are decision rules? How to use it for classifying new samples?   [10]

   (b) Write first order logic equivalent of the following statements: [10]
   - (i) Anand likes only comedy films.
   - (ii) The culprit has to be one from Tinker, Tailor and Butler.
   - (iii) Whoever can read is literate.
   - (iv) Every child loves Santa.
   - (v) Some birds cannot fly.

Q3 (a) Design a classical planner for air cargo transportation problem using STRIPS. The   [10]
   problem involves loading, unloading cargo and flying it from place to place. Define
   three actions: Load, Unload and Fly. The actions affect two predicates: In(c, p) means
   that cargo c inside plane p, and At(x, a) means that object x (either plane or cargo) is at
   airport a.

   (b) Give a formal definition of a Bayesian Belief Network (BBN). Illustrate the process   [10]
   of constructing a BBN with a suitable scenario. What type of inferences can be drawn
   from BBN network?

                                                                                             PTO
Q4 (a) Compare **Breadth first search (BFS), Depth first search (DFS), Depth limited   [10]
   search (DLS)** and **Iterative Deepening search** algorithms based on performance
   measure with justification: Complete, Optimal, Time and Space complexity.
   (b) Write a pseudo code for alpha-beta algorithm. Apply alpha-beta pruning on example   [10]

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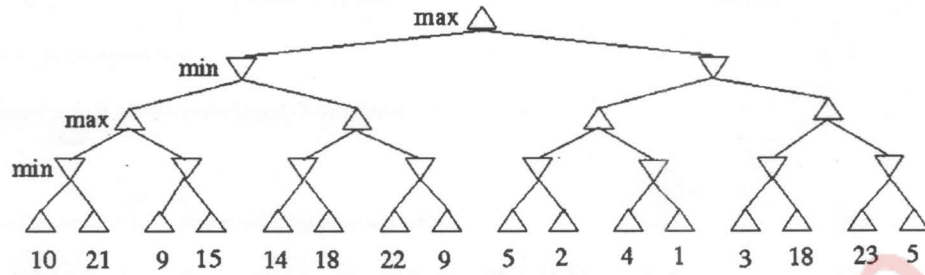
given in Figure 1 considering first node as max.

Figure 1

Q5 (a) How will you convert the propositional logic statement into CNF? Give a suitable example at each step? [10]

(b) Consider the graph given in Figure 2 below. Assume that the initial state is **S** and the goal state is **G**. Show how **A* Search** would create a search tree to find a path from the initial state to the goal state: [10]
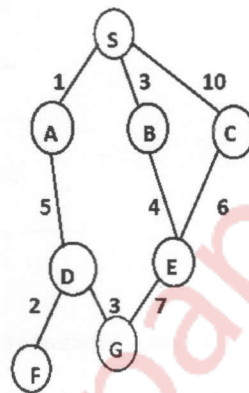

Figure 2

At each step of the search algorithm, show which node is being expanded, and the content of fringe (OPEN). Also report the eventual solution found by the algorithm, and the solution cost. Assuming the straight-line distance as the heuristics function: h(S)= 13, h(A)=7, h(B)=9, h(C)=11, h(D)=2, h(E)=4, h(F)=1, and h(G)=0.

Q6 Answer any two (2) of the following [20]

(a) What are the steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence.

(b) Draw and describe each component in the Architecture of Expert System with a suitable example

(c) Explain how Genetic algorithms work. Define the terms chromosome, fitness function, crossover and mutation as used in Genetic algorithms

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Time: 3 Hours   May-19   **Total Marks = 80**

Note:
   (i) Each question carries 20 marks
   (ii) **Question 1** is compulsory
   (iii) Attempt any **three (3)** from the remaining questions
   (iv) Assume suitable data wherever required

Q1.   Attempt any **four (4)** questions from the following: [20]
   (a) Compare Model based agent with Goal based agent.
   (b) Given a full 5-gallon jug and an empty 3- gallon jug, the goal is to fill the 3-gallon jug with exactly one gallon of water. Give state space representation
   (c) Explain conditional independence relation in belief network with example
   (d) Describe the environmental characteristics of WUMPUS world Puzzle.
   (e) What is Supervised and Unsupervised learning? Give example of each.

Q2 (a) Draw and illustrate the Architecture of Learning agent. Describe each of its component w.r.t. Medical diagnosis system   [6+4]

   (b) Distinguish between Propositional logic (PL) and first order predicate logic (FOPL) knowledge representation mechanisms. Take suitable example for each point of differentiation.   [10]

Q3 (a) Consider the following set of sentences   [10]
      a) Whoever can read is literate
      b) Birds are not literate
      c) Some birds are intelligent

   Prove the following using forward reasoning **"Some who are intelligent cannot read"**

   (b) Evaluate **IDA* search** algorithms based on performance measures such as Complete, Optimal, Time and Space complexity with justification. Illustrate its working with a suitable example.   [6+4]

Q4 (a) Apply Alpha-Beta Pruning on following example   [10]
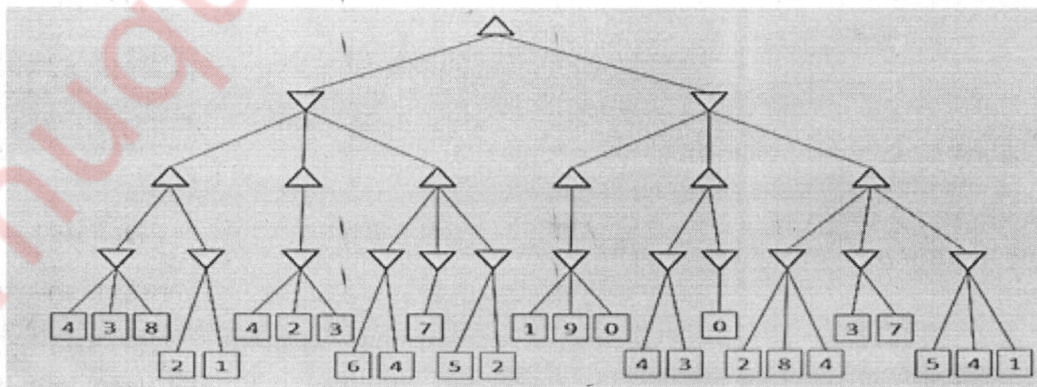
(b) Define Belief Network. Describe the steps of constructing belief network with an example. What types of inferences can be drawn from that? [2+6+2]]

Q5 **(a)** Explain Partial order planning with example. [10]

(b) Describe each component in the architecture of Expert System? What are the limitations of Expert System? [10]

Q6 Answer any **two (2)** of the following [20]

(a) Construct the decision tree from the following set of training data. Classify the new record: outlook=rain, temp =70, humidity=65, windy=true.

Tid	Refund	Marital Status	Taxable Income	Cheat
1	Yes	Single	>100	No
2	No	Married	80-100	No
3	No	Single	<80	No
4	Yes	Married	>100	No
5	No	Divorced	80-100	Yes
6	No	Married	<80	No
7	Yes	Divorced	>100	No
8	No	Single	80-100	Yes
9	No	Married	<80	No
10	No	Single	80-100	Yes

(b) What are steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence.

(c) Write a short note on local search algorithms.

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(**3 Hours**)   Dec19   (**Total Marks : 80**)

Note: 1. Question 1 is compulsory.
2. Attempt any 3 from Q2 to Q6.
3. Indicate your answer with various sketches whenever necessary.

Q1 Attempt any **four**.   **[20]**

(a) State PEAS Description for online English tutor.

(b) Differentiate between Soft and Hard computing.

(c) Give Local and Global heuristic function for block world problem.

(d) Give different membership functions of fuzzy logic.

(e) Determine (alfa) α-level sets and strong α-level sets for the following fuzzy sets. A={(1,0.2), (2,0.5), (3, 0.8), (4,1), (5, 0.7), (6,0.3)}

Q2 (a) Consider the graph given in Figure 1 below. Assume that the-initial state is S   **[10]**
and the goal state is 7. Find a path from the initial state to the goal state using A* Search. Also report the solution cost. The straight line distance heuristic estimates for the nodes are as follows: $h(1)=14$, $h(2)=10$, $h(3)=8$, $h(4)=12$, $h(5)=10$, $h(6)=10$, $h(S)=15$.
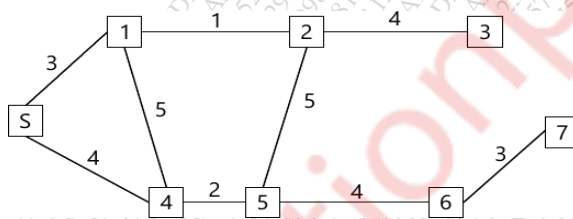
(b) The law says that it is a crime for an American to sell weapons to hostile   **[10]**
nations. The country Nono, an enemy of America, has some missiles, and all of its missiles were sold to it by Colonel West, who is American.
Prove that Col. West is a criminal using resolutfion technique.

Q3 (a) Implement AND function using perceptron networks for bipolar inputs and   **[10]**
targets.

(b) Explain fuzzy controller system for a tipping example.Consider service and   **[10]**
food quality rated between 0 and 10. use this to leave a tip of 25%.

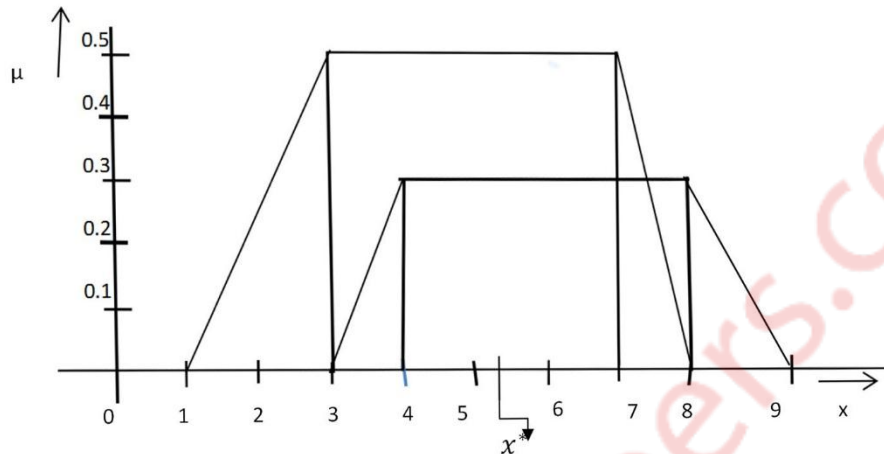Q4 (a) Design a Mc-Culloh Pitts model for XOR Gate.   **[10]**

(b) Construct kohonen Self-organizing map to cluster the four given vectors,   **[10]**

[0 0 11], [1 0 0 0], [0 11 0] and [0 0 0 1]. The number of cluster formed is two. Assume an initial learning rate of 0.5.

Q5 (a) Explain defuzzification techniques. Apply defuzzification by using Center of Gravity (CoG) method on the following: **[10]**

(b) Explain planning problem in AI. What are different types of planning? Consider problem of changing a flat tire. The goal is to have a good spare tire properly mounted on to the car's axle, where the initial state has a flat tire on the axle and a good spare tire in the trunk. Give the ADL description for the problem. **[10]**

Q6 Write Short notes on following **(Any Four)** **[20]**
   (a) Genetic algorithm
   (b) ANFIS
   (c) Hill Climbing algorithm
   (d) Wumpus world knowledge base
   (e) Different types of Neural Networks

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University of Mumbai Examination 2020

Program: Computer Engineering : SEM VII R2016 scheme CBCGS

Curriculum Scheme: Rev2016
Examination: BE Semester VII
Course Code: CSC703 and Course Name: Artificial Intelligence and Soft Computing

Time: 80 Mins. (16.10-17.30)
Max. Marks: 40

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* Required

1. Email *

   _____

2. Exam Seat No: *

   _____

3. Name of Student: *

   _____

4. Name of Examination: *

   Mark only one oval.

   ⬭ R16(CBCGS)

5. Name of Course: *

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6. Semester: *

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7. Name of Subject: *
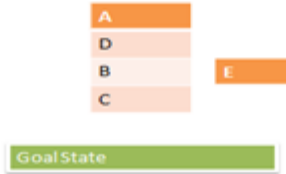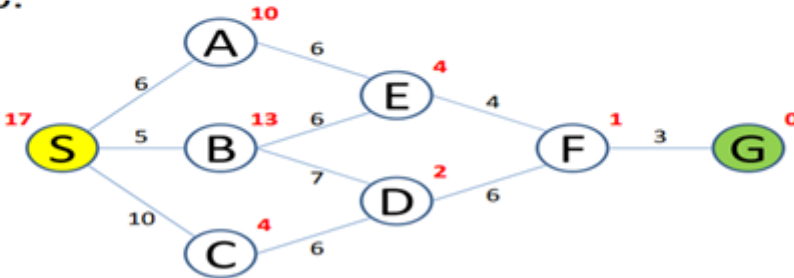
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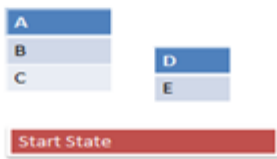
8. Exam Date: *

Mark only one oval.

◯ 13/01/2021

Descriptive Questions

Combine answers of 2A and 2B in one single PDF.
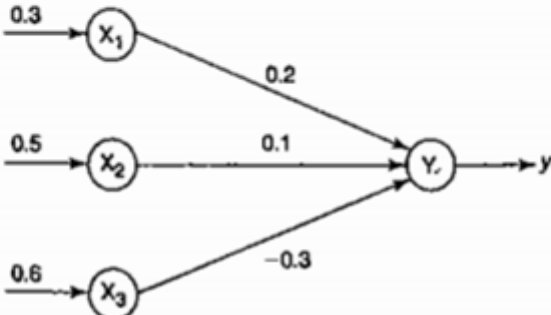
Q2A	Solve any Two 5 marks each
i.	Give PEAS Description of Online Teaching. Explain which type of agent is required for the same.
ii.	Consider the following initial state and the goal state for a block world problem. Solve the problem using Hill Climbing algorithm, so as to reach from initial state to the goal state. Consider $h1(n)$ – Add 1 if block is on correct block/ goal pattern, Subtract 1 if on wrong block and $h2(n)$ - Add 1 for every block in a correct structure that the block is sitting on, subtract 1 for every block Note down your observations after solving for $h1$ and $h2$
iii.	Solve the below graph by using A* search algorithm. Consider S to be the start node and G is the goal node. The heuristics values and the distance between the nodes are given in the graph.

9. *

Q2 B	Solve any One 10 marks each
i.	Consider the following axioms: 1. Every child loves Santa. 2. Everyone who loves Santa loves any reindeer. 3. Rudolph is a reindeer, and Rudolph has a red nose. 4. Anything which has a red nose is weird or is a clown. 5. No reindeer is a clown. 6. Scrooge does not love anything which is weird. 7. (Conclusion) Scrooge is not a child. Solve by resolution.
ii.	What is perceptron? Give a perceptron model for XOR and AND gate.

Files submitted:

10. Q.3 *

Q3	
A	Solve any Two 5 marks each
i.	For the following network calculate the net input given to the output neuron.
ii.	Explain Genetic algorithm steps.
iii.	Write a note on ANFIS system.
B	Solve any One 10 marks each
i.	Consider two inputs I1 and I2. These two inputs have the following linguistic states: I1 : L(low), M(Medium), H(High) I2 : NR(Near), FR (Far), VF(Very Far) The output of any i-th rule can be expressed by the following: yi = f (I1, I2) = aji I1 + bki I2 ; where, j,k = 1,2,3. Suppose: a1i = 1, a2i = 2, a3i = 3 if I1 = L, M and H, respectively. b1i = 1, b2i = 2, b3i = 3 if I2 = NR, FR, and VF, respectively. Calculate the output of FLC for I1 = 6.0 and I2 = 2.2 using Takagi and Sugeno approach.
ii.	Explain Spare tire problem using conditional planning.

Files submitted:

Google Forms