Sardar Vallabhbhai National Institute Of Technology, Surat
Computer Science and Engineering Department
B.Tech III (Computer Science and Engineering) - VI Semester
CS304 - Artificial Intelligence
Mid Semester Exam March-2023

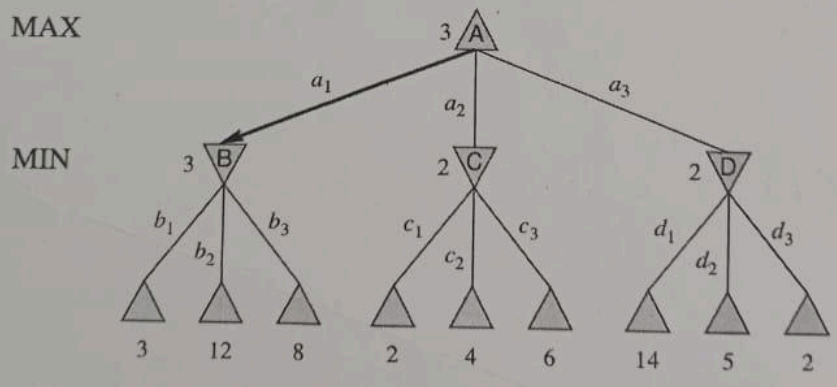
Date: 15th March 2023 **Time: 11:00 am to 12:30 pm** **Marks:30**

Instructions:

1. Write your Admission number / Roll number and other details clearly on the answer books.
2. Be precise and clear in answering the questions.
3. Draw neat and clean diagram wherever required.

Q-1 Answer the following. **[20]**

1. Write pseudocode agent programs for the goal-based and utility-based agents.
2. Explain best first search with appropriate example. Can we consider depth first search as a special case of depth first tree search? Justify your answer.
3. Explain what is admissibility and consistency for the heuristic function for A* algorithm? Devise a state space in which A* using GRAPH-SEARCH returns a suboptimal solution with an h(n) function that is admissible but inconsistent.
4. What is the difference between hill climbing and simulated annealing method? Which of the two is better for a large scale optimization task? Justify your answer with a suitable example.
5. Consider a two player game tree below. The terminal nodes show the utility values for MAX.
   a) Show optimal decision for the game tree with both MINMAX and Apha-Beta algorithm. Show step by step process with an appropriate diagram and explanation.



Q-2 Answer the following. [Any 2] **[10]**

1. Answer the following.
   a) Illustrate different types of knowledge in detail. [2 marks]
   b) Write the tautology for [3 marks]
      I. Hypothetical Syllogism
      II. Modus Tollens
      III. Disjunctive Syllogism

2. Answer the following.
   a) Which quantifiers are used in predicate logic? Explain it with help of example. [2 marks]
   b) Explain unification with the help of example. [2 marks]
   c) List out the approaches used in normal forms. [1 marks]

3. Consider following statements:
   1. John likes all kind of food.
   2. Apple and vegetable are food
   3. Anything anyone eats and not killed is food.
   4. Anil eats peanuts and still alive.
   5. Harry eats everything that Anil eats.

   Prove that "John likes peanuts" via the resolution method. Show all the steps.

******* ALL THE BEST*******

$\frac{(P \vee Q) \sim P \wedge R}{Q \vee R}$

Sardar Vallabhbhai National Institute Of Technology, Surat
Computer Science and Engineering Department
B.Tech III (Computer Science and Engineering) - VI Semester
CS304 - Artificial Intelligence
End Semester Exam May-2023

Date: 4th May 2023 **Time: 9:30 AM to 12:30 PM** **Marks:50**

Instructions:
1. Write your Admission number / Roll number and other details clearly on the answer books.
2. Be precise and clear in answering the questions.
3. Draw neat and clean diagram wherever required.

Q-1 Answer the following. [6]

1. What are the differences between agent functions and agent programs? Can there be more than one agent program that implements a given agent function? Justify your answer.

2. Consider the sensorless version of the erratic vacuum world. Draw the belief-state space reachable from the initial belief state {1, 2, 3, 4, 5, 6, 7, 8}, and explain why the problem is unsolvable.

3. Compare best first and greedy best first search with suitable example.

Q-2 Answer the following. [Any two] [8]

1. Draw the architecture of knowledge-based agent and explain each block of it.

2. Convert the following first-order logic expressions to normal form. Show all steps properly.
$\forall x$:([roman(x) ^ know(x,Markus)] ->[hate(x, ceaser)) V ($\forall y$: $\exists z$:hate(y,z)) ->thinkcrazy(x,y))

3. For each of the following sentences in English, decide if the accompanying first-order logic sentence is a good translation. If not, explain why not and correct it. (Some sentences may have more than one error!)
   a) No two people have the same social security number.
   $\neg\exists$ x, y, n Person(x) $\wedge$ Person(y) $\Rightarrow$ [HasSS#(x, n) $\wedge$ HasSS#(y, n)].
   b) John's social security number is the same as Mary's.
   $\exists$ n HasSS#(John, n) $\wedge$ HasSS#(Mary, n).
   c) Everyone's social security number has nine digits.
   $\forall$ x, n Person(x) $\Rightarrow$ [HasSS#(x, n) $\wedge$ Digits(n, 9)].
   d) Rewrite each of the above (uncorrected) sentences using a function symbol SS# instead of the predicate HasSS#.

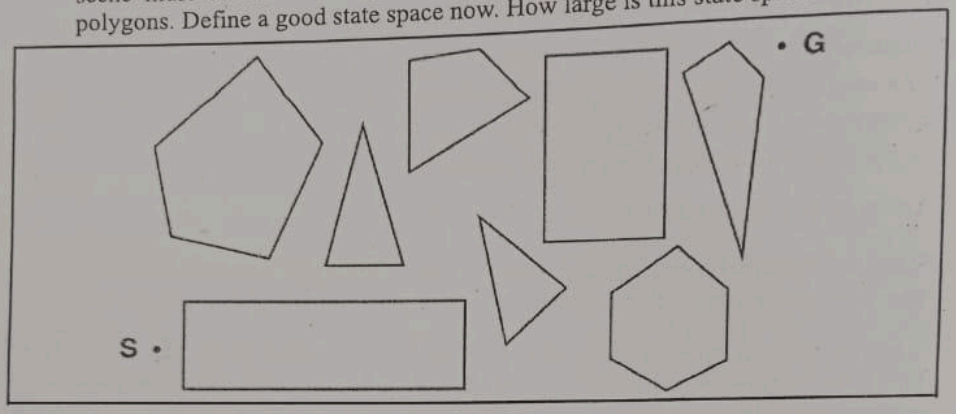
Q-3 Answer the following. [12]

1. Consider the problem of finding the shortest path between two points on a plane that has convex polygonal obstacles as shown in Figure. This is an idealization of the problem that a

robot has to solve to navigate in a crowded environment.

a) Suppose the state space consists of all positions (x, y) in the plane. How many states are there? How many paths are there to the goal?

b) Explain briefly why the shortest path from one polygon vertex to any other in the scene must consist of straight-line segments joining some of the vertices of the polygons. Define a good state space now. How large is this state space?



2. Explain Hill Climbing search strategy and also compare it with A* algorithm based on different properties such as completeness, optimality, time complexity and space complexity.

3. Explain minimax search process. In a full-depth minimax search of a tree with depth D and branching factor B, with α-β pruning, show what is the minimum number of leaves that must be explored to compute the best move?

Q-4 Answer the following. [Any three] [12]

1. Represent the following knowledge using semantic network.
   a) A trout is a fish.
   b) A fish has gills.
   c) A Fish has fins.
   d) Fish is food.
   e) Fish is animal.
   f) An apple is a fruit.
   g) Fruit has stem.
   h) Fruit is food.
   i) Fruit is a vegetable.
   j) An animal is a living thing.
   k) A vegetable is a living thing.

2. Explain the methods of Defuzzification.

3. Use Bayes theorem for the given problem statement: 1% of the population get cancer, 80% of people with cancer get a positive test, 9.6% of people without cancer also get a positive

test. A person has a test for cancer that comes back positive. What is the probability that they actually have cancer?

4. Explain the reactive system with proper diagram.

Q-5 Answer the following(Any three). [12]

1 What is the minimum remaining value(MRV) and least constraining value heuristic? Explain why it is a good heuristic to choose the variable that is most constrained but the value that is least constraining in a CSP search.

2 Explain Arc consistency. Consider a CSP with three variables: A,B and C. Each of three variables can take on one of two values: either 1 or 2. There are three constraints: A≠B, B≠C, and A≠C. What values for what variables would be eliminated by enforcing arc-consistency? Explain your answer.

3 What is statistical natural language processing? Explain briefly with one suitable application.

4 Explain forward chaining and backward chaining in Expert Systems.

******* ALL THE BEST*******

$P(C|P) = \frac{P(C \cap P)}{P(P)}$

$P(P|C) = \frac{P(C \cap P)}{P(C)}$