

## **2081:**

Long Answer Questions: [10 marks each]

1. How can you relate synapse, dendrite, and axon in biological neural networks with the elements of artificial neural networks? Create a multi-layer ANN with input layer, hidden layer, and output layer. Assume necessary inputs and weights to the ANN and illustrate a single iteration of backpropagation algorithm to train the ANN.
  
2. What is Skolem constant? How is Skolemization done during resolution? Represent the following statements into FOPL.
  - a. All movies are not hit.
  - b. Sarangi is a movie.
  - c. All movies which have good script are hit.
  - d. Sarangi has a good script, but Sarangi is sentimental.
  - e. There is a movie which is comedy.
  
3. How is informed search different from uninformed search? Create a state space with appropriate heuristics, now illustrate how hill climbing search expands nodes to reach a goal. Modify the state space heuristics and demonstrate when the hill climbing will not be complete.

Short Answer Questions: [5 marks each]

4. What is intelligence? Describe the foundation of AI.
5. What is reinforcement learning? Configure an ANN neuron to simulate OR gate.

6. How uniform cost search is used to search for goal in the state space ? Illustrate with example.
7. How can you represent knowledge using scripts? Create a knowledge base using script based on your own assumption.
8. What is reinforcement learning? Configure an ANN neuron to simulate OR gate.
9. What is robotics? How machine vision is used in robotics?
10. Define fuzzy logic. Construct a fuzzy rule-based expert system with your own considerations of fuzzy set.
11. How is minmax algorithm used in game search? Consider state space is defined by a collection of pairs like (A, B) representing paths between states A and B.  
Construct state space for following and use a minmax algorithm:  
  
(A, B), (A, C), (B, D), (D, E), (C, F), (C, G), (D, H), (D, I), (E, J), (F, K), (F, L), (G, M), (G, N).

The utilities for states H, I, J, K, L, M, N are 1, 3, 2, 6, 3, 4, 1 respectively.

12. Justify which type of environments resembles following agents.
  - a. Mission Game with fixed 6 states having two players.
  - b. Tesla Driverless Robovan where road conditions are changing.
  - c. Game Result Predicting Agent where current prediction state is independent of previous state.

## **2080-new:**

Long Answer Questions: [10 marks each]

1. Define state space graph. Differentiate between A\* search and greedy best first search.
2. What do you mean by unification and lifting ? Convert following sentences into FOPL.
  - a. ‘Sushma likes all kinds of practical courses.
  - b. AI and DBMS are practical courses.
  - c. Any subject anyone practices is practical course.
  - d. Ruby practices PHP.
  - e. Rita practices everything that Ruby practices.

Using resolution check whether "Sushma likes PHP" is inferred or not.

3. Differentiate supervised learning from unsupervised? Discuss how Naive Bayes Model can be used for machine learning ? Support your answer with example.

Short Answer Questions: [5 marks each]

4. How can you define AI from the dimension of behavioral process? When a machine is said to pass Turing Test?
5. What is an agent ? How does utility agent work? Give an example of utility agent.
6. What is game search? How minmax search used in game playing ? Illustrate with an example.

7. What is semantic network? Given following knowledge base, represent it using semantic network:

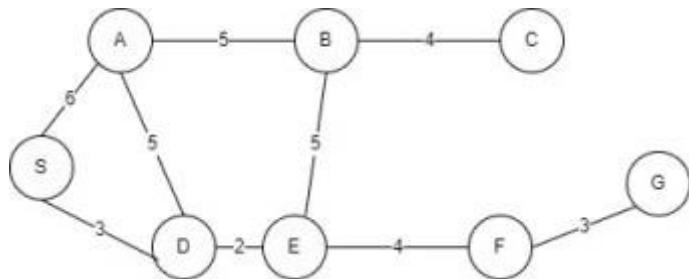
Subash is a student. All students are person. Person has hair. Ram is a player. All player play game. Game is a physical action. Height of all players is larger than the height of all student. Physical action starts from 7:00 AM and ends at 9:00AM.

8. Discuss how genetic algorithm works?
9. Using your own assumptions, design PEAS framework for following intelligent agents.
  - a. Medicine delivery drone
  - b. Covid medicine prescriber.
10. What is machine vision? Describe the components of machine vision.
11. How does natural language generation differs from natural language understanding ? How do morphological analysis do in NLP?
12. What is constraint satisfaction problem? Illustrate graph coloring problem as constraint satisfaction problem.

## **Model:**

Long Answer Questions: [10 marks each]

1. What do you mean by heuristic search? Given following state space representation, show how greedy best first and A\* search is used to find the goal state.



S is the start state and G is the goal state. The heuristics of the states are:

$$h(S) = 12, h(A)=8, h(D)=9, h(B)=7, h(E)= 4, h(C)=5, h(F)=2, h(G)=0.$$

2. How resolution algorithm is used as a rule of inference in predicate logic?

Convert the following sentences into FOPL.

- a. All over smart people are stupid.
- b. Children of all stupid persons are naughty.
- c. Roney is children of Harry.
- d. Harry is over smart.

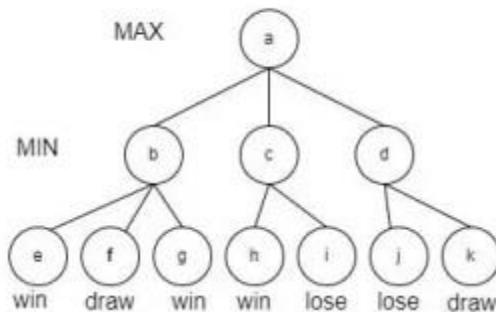
Prove that “Roney is naughty” using resolution algorithm.

3. What is artificial neural network? Define its mathematical model. Discuss how back propagation algorithm is used to train ANN.

Short Answer Questions: [5 marks each]

4. Describe how Turing test is used to define AI as acting humanly.
5. Differentiate between model based and simple reflex agent with an example.
6. What is natural language processing? Discuss the steps of natural language processing,
7. How belief networks are constructed? Consider the probability of being cloudy is 50%. The probability that it will rain given the conditions it will be cloudy and if it is winter is 30%. The probability of winter is 50%. The probability that it will be sunny is 70%. Now construct a belief network for this example.
8. What is expert system? Explain the major components of expert system.
9. What is supervised learning? Discuss how Naive Bayes model works.
10. Construct semantic network for the following facts:

Ram is a person. Persons are humans. All humans have a nose. Humans are instances of mammals. Ram has a weight of 60 kg. The weight of Ram is less than the weight of Sita.
11. How is the Min–Max algorithm used in game search? For the following state space, show how the Min–Max algorithm finds the path for the two players.



12. Construct a PEAS framework for the following intelligent agents:

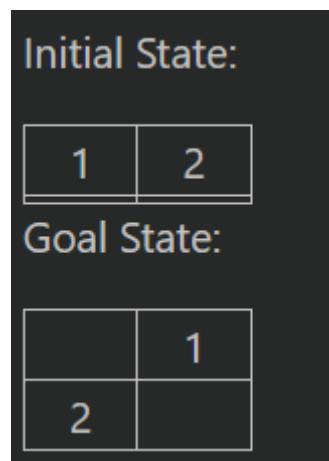
a. Internet Shopping Assistant

b. English Language Tutor

## 2080:

Long Answer Questions: [10 marks each]

1. Prepare a state space graph for the following puzzle problem, where only move left, move right, move up, and move down actions are allowed. On the constructed state space, label the states as A, B, C, ..., Z, and use the Greedy Best-First algorithm to test whether it finds the goal or not.



Assume the path cost from one step to another is 1, and the heuristic function  $f(n)$  is the number of misplaced cells.

2. Write the rules to convert statements in predicate logic into CNF form. Convert the following sentences into FOPL.
  - a. All students of BSc CSIT are intelligent persons.
  - b. All friends of intelligent persons are smart.
  - c. Laxmi is a friend of Rojina.
  - d. Rojina is smart.
  - e. All beautiful students are girls.
  - f. Laxmi is beautiful.

Using resolution algorithm infer that “Laxmi is smart”.

3. What is the role of activation function in ANN? How does the sigmoid function work? Discuss about perceptron learning.

Short Answer Questions: [5 marks each]

4. What is the Turing Test? What properties should an agent have to pass the Turing Test?
5. What are the properties of an intelligent agent? How do simple reflex agents work? Give an example of a simple reflex agent.
6. Why is alpha–beta pruning necessary? How is alpha–beta pruning done in game search? Illustrate with an example.
7. How is knowledge represented using frames? Represent the following knowledge using frames:

Ram is the name of an employee. He is 27. He is male. He belongs to the department HR, where the number of employees is 110 and the average salary is Rs. 45,000. All departments are under Tribhuvan University. The organization type of Tribhuvan University is Educational.

8. Define selection, crossover, and mutation operations in Genetic Algorithm.
9. Design PEAS framework for the following intelligent agents:
  - a. COVID-19 prediction system
  - b. Vaccine recommender system
10. Describe the components of an Expert System.
11. Why is pragmatic analysis necessary in NLP? How is pragmatic analysis performed?

12. How is iterative deepening search used to find a path from the initial state to the goal state in state-space representation of any problem? Illustrate with an example.

## **2079:**

Long Answer Questions: [10 marks each]

1. Define admissible heuristic with an example. Explain the working mechanism and limitations of hill-climbing search.
2. How do you define a problem? What are the criteria for defining a problem? Compare Constraint Satisfaction Problem (CSP) and Real-World Problem in detail with appropriate examples.
3. Define Expert System with example. What are the stages of Expert System development? Explain.

Short Answer Questions: [5 marks each]

4. How are syntactic and semantic analyses performed in Natural Language Processing (NLP)?
5. What do you mean by Rational Agent? What are the differences between a Utility-based agent and a Model-based agent?
6. What is state-space representation? Illustrate with one example.
7. What is forward chaining? Explain with an appropriate example.
8. Convert the following sentences into Predicate Logic:
  - a. All animals who can bark are dogs.
  - b. Someone is firing a gun.
  - c. All tigers are not fierce.
9. Define game. Write the benefits and limitations of Depth-Limited Search.
10. What is fuzzy logic? Discuss the different operators used in Genetic Algorithm.

11. Give an example of reinforcement learning. Explain the types of Artificial Neural Networks (ANN).

12. Write short notes on:

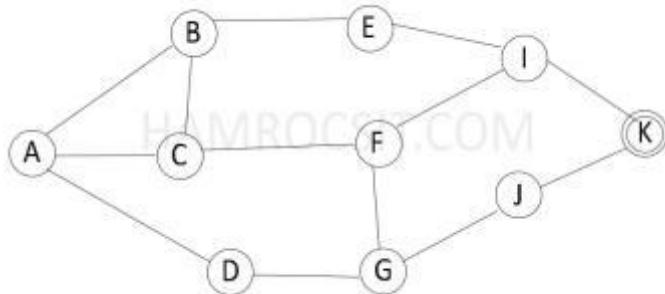
- a. Pragmatic Analysis
- b. Unification and Lifting
- c. Turing Test

## 2078:

Long Answer Questions: [10 marks each]

1. How informed search are different than uniformed? Given following state space, illustrate how depth limited search and iterative depending on search works?

Use your own assumption for depth search.



Hence, A is start and K is goal.

2. Consider following facts:

Every traffic chases driver. Every driver who horns is smart. No traffic catches any smart driver. Any traffic who chases some driver but does not catch him frustrated.

Now configure FoPL knowledge base for above statements. Use resolution algorithm to draw a conclusion that “If all drivers horn, then all traffics are frustrated.”

3. Describe mathematical model of neural network. What does it mean to train a neural network? Write algorithm for perceptron learning.

Short Answer Questions: [5 marks each]

4. What is Turing test? How it can be used to measure intelligence of machine?
5. How agent can be configured using PEAS framework? Illustrate with example.
6. Construct semantic network for following facts.

Ram is person. Persons are humans. All human have nose. Humans are instances of mammals. Ram has weight of 60 kg. Weight of Ram is less than weight of Sita.

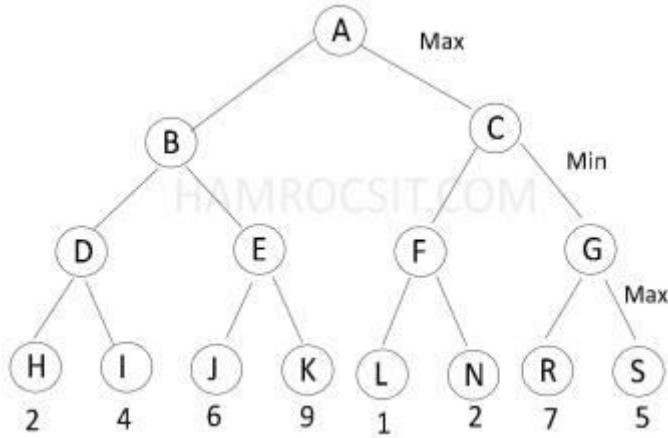
7. What is crossover operation in genetic algorithm? Given following chromosomes show the result of one-point and two-point crossover.

C1 = 01100010

C2 = 10101100

Choose appropriate crossover points as per your own suggestions.

8. What is expert system? How does it work? Mention role of inference engine in expert system.
9. How semantic and pragmatic analysis is done in natural language processing.
10. How does philosophy, sociology and economics influence the study of artificial intelligence?
11. Given following search space, determine if there exists any alpha and beta cutoffs.



12. What is posterior probability? Consider a scenario that a patient have liver disease is 15% probability. A test says that 5% of patients are alcoholic. Among those patients diagnosed with liver disease, 7% are alcoholic. Now computer the chance of having liver disease, if the patient is alcoholic.

## **2076:**

Long Answer Questions: [10 marks each]

1. Construct a state space with appropriate heuristics and local costs. Show that Greedy Best First search is not complete for the state space. Also illustrate A\* is complete and guarantees solution for the same state space.
2. How resolution algorithm is used in FOPL to infer conclusion?

Consider the facts:

Anyone whom Pugu loves is a star. Any hero who does not rehearse does not act. Anmol is a hero. Any hero who does not work does not rehearse. Anyone who does not act is not a star. Convert above into FOPL and use resolution to infer that “If Anmol does not work, then Pugu does not love Anmol”.

3. Define mathematical model of artificial neural network. Discuss how Hebbian learning algorithm can be used to train a neural network. Support your answer with an example.

Short Answer Questions: [5 marks each]

4. What is AI? How can you define AI from the perspective of thought process?
5. Discuss the types of environment where an agent can work on.
6. Illustrate with an example, how uniform cost search algorithm can be used for finding goal in a state space.
7. Define frame. How knowledge is encoded in a frame? Justify with an example.

8. What do you mean by membership of an element in a fuzzy set? Given a domain of discourse  $X=\{10, 20, 30, 40, 50, 60, 70\}$ , construct a fuzzy set from X. Use your own assumptions for defining membership.
9. Write an algorithm for learning by Genetic Approach.
10. How uncertain knowledge is represented? Given following full joint probability distribution representing probabilities of having different sizes of CD, find the probability that a CD cover has a length of 130mm given the width is 15mm.

y=Width	X=Length		
	129	130	131
15	0.12	0.42	0.06
16	0.08	0.28	0.04

11. How the concept of machine vision are used in Robotics to configure sensors of Robots?
12. How syntactic and semantic analysis is done during natural language processing? Explain with example.