What is Artificial Intelligence?

Artificial Intelligence is the study of how to make computers do things which at the moment people do better

What are the different types of agents?

A human agent has eyes, ears, and other organs for sensors and hands, legs, mouth, and other body parts for actuators. A robotic agent might have cameras and infrared range finders for sensors and various motors for actuators. A software agent receives keystrokes, file contents, and network packets as sensory inputs and acts on the environment by displaying on the screen, writing files, and sending network packets. Generic agent – A general structure of an agent who interacts with the environment.

Define rational agent?

For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has. A rational agent should be autonomous

List down the characteristics of intelligent agent.

Internal characteristics are – Learning/reasoning: an agent has the ability to learn from previous experience and to successively adapt its own behavior to the environment. – reactivity: an agent must be capable of reacting appropriately to influences or information from its environment. – autonomy: an agent must have both control over its actions and internal states. The degree of the agent’s autonomy can be specified. There may need intervention from the user only for important decisions. – Goal-oriented: an agent has well-defined goals and gradually influence its environment and so achieve its own goals.

– communication: an agent often requires an interaction with its environment to fulfill its tasks, such as human, other agents, and arbitrary information sources. – cooperation: cooperation of several agents permits faster and better solutions for complex tasks that exceed the capabilities of a single agent. – mobility: an agent may navigate within electronic communication networks. – Character: like human, an agent may demonstrate an external behavior with many human characters as possible.

What is PEAS?

PEAS (Performance, Environment, Actuators, Sensors)

What things we should do to built a system?

Define the problem precisely  Analyze the problem  Isolate and represent the task knowledge that is necessary to solve the problem  Choose the best problem solving technique

What production system consists of? 

A set of rules, each consists of a left side that determines the applicability of the rule and a right side that describes the operation to be performed if the rule is applied.  One or more knowledge database that contains whatever information is appropriate for particular task.  A control strategy that specifies the order in which the rules will be compared to the database and a way of resolving the conflict that arises when several rules match at once

What are the advantages of Breadth First Search?

BFS will not get trapped exploring a blind alley. This contrast to the DFS which may follow a single unfruitful path for a very long time, perhaps forever before the path actually terminates in a state that has no successors.  If there is a solution, then BFS is guaranteed to find it. Furthermore, if there are multiple solutions then a minimal solution will be found.

What are the advantages of Depth First Search?

DFS requires less memory since only the nodes on the current path are stored. In contrast to BFS where all the tree that has so fab been generated must be stored.  By chance, DFS may find a solution without examining much of the state space at all, where in BFS the entire tree must be examined to level n before any nodes on level n+1 can be examined.

What is Heuristic Search?

A heuristic search is a technique that improves the efficiency of a search process, possibly by sacrificing claims of completeness.

What is Heuristic Function?

A function that maps from problem state description to measures of desirability, usually represented as numbers

Write Generate and Test algorithm.

Generate a possible solution. For some problems this means generating a particular point in the problem space. For others, it means generating a path from a start state.  Test to see if this is actually a solution by comparing the chosen point or the end point of the chosen path to the set of acceptable goal states.  If a solution has been found, quit otherwise return step1

What is the difference between Simple Hill Generate and Test algorithm Climbing

The key difference between Simple Hill Climbing and Generate and Test algorithm is the use of an evaluation function as a way to inject task-specific knowledge into the control process.

What is Local Maxima?

local maxima is a state that is better than all its neighbor but is not better than some other states father away. At local maxima all the moves appear to make things worse. Local maxima are particularly frustrating because they often occur almost within sight of a solution. In this case they are called foothills.

What is a plateau?

It is a flat area of the search space in which a whole set of neighboring states have the same value. On a plateau it is not possible to determine the best direction in which to move by making local comparisons.

What is a Ridge?

A ridge is a special kind of local maximum. It is an area of the search space that is higher than surrounding area and that itself has a slope.

Differentiate uniformed and informed search?

Uninformed or blind search strategies uses only the information available in the problem definition • Informed or heuristic search strategies uses additional information

What are the ways to formulate the problem?

1. A set of states S

2. An initial state si  S

3. A set of actions A s Actions(s) = the set of actions that can be executed in s,— that are applicable in s. srActions(s) Result(s, a)  a s

4. Transition Model: —sr is called a successor of s —{si Successors(si} )\* = state space

5. Goal test Goal(s) — Can be implicit, e.g. checkmate(x) — s is a goal state if Goal(s) is true

6. Path cost (additive) —e.g. sum of distances, number of actions executed, … —c(x,a,y) is the step cost, assumed ≥ 0 – (where action a goes from state x to state y)

What is frame problem?

The frame problem in AI is concerned with the question of what piece of knowledge is relevant to the situation.

What is Poblem graph ?

The AND-OR GRAPH (or tree) is useful for representing the solution of problems that can solved by decomposing them into a set of smaller problems, all of which must then be solved. This decomposition, or reduction, generates arcs that we call AND arcs.One AND arc may point to any number of successor nodes, all of which must be solved in order for the arc to point to a solution. Just as in an OR graph, several arcs may emerge from a single node, indicating a variety of ways in which the original problem might be solved. This is why the structure is called not simply an AND-graph but rather an AND-OR graph (which also happens to be an AND-OR tree)

How much knowledge would be required by a perfect program for the problem of playing chess? Assume the unlimited computing power is available.

The rules for determining legal moves and some simple control mechanism that implements an appropriate search procedure. Additional knowledge about such things as good strategy and tactics could of course help considerably to constrain the search and speed up the execution of the program.

Give the structure of an agent in an environment.

Agent interacts with environment through sensors and actuators. A general structure of an agent interacts with the environment.

List the criteria to measure the performance of search strategies.

Completeness  Time complexity  Space complexity  Optimality

List some of the uninformed search techniques.

Uninformed Search Techniques: –Depth-first Search –Breadth-first Search –Iterative Deepening

What are the capabilities, computer should posses to pass Turing test?

Natural Language Processing Knowledge representation Automated reasoning Machine Learning

What are the capabilities, computer should posses to pass Turing test?

Natural Language Processing Knowledge representation Automated reasoning Machine Learning

What is important for task environment?

PEAS → P- Performance measure E - Environment AActuators S – Sensors

Define problem solving agent.

Problem solving agent is one kind of goal based agent, where the agent Should select one action from sequence of actions which lead to desirable states.

List the steps involved in simple problem solving technique.

i. Goal formulation ii. Problem formulation iii. Search iv. Solution v. Execution phase

What are the components of a problem?

There are four components. They are i. initial state ii. Successor function iii. Goal test iv. Path cost v. Operator vi. state space vii. Path

Give example for real world end toy problems.

Real world problem examples: i. Airline travel problem. ii. Touring problem. iii. Traveling salesman problem. iv. VLSI Layout problem v. Robot navigation vi. Automatic Assembly vii. Internet searching Toy problem Examples: Vacuum world problem. 8 – Queen problem 8 – Puzzle problem

Define fringe.

The collection of nodes that have been generated but not yet expanded, this collection is called fringe or frontier

Define Path Cost.

A function that assigns a numeric cost to each path, which is the sum of the cost of the each action along the path.

Define Path.

A path in the state space is a sequence of state connected by sequence of actions.

What is environment program?

It defines the relationship between agents and environments.

List the properties of environments.

o Fully Observable Vs Partially Observable

o Deterministic Vs Stochastic o Episodic Vs Sequential

o Static Vs Dynamic o Discrete Vs Continuous

o Single Agent Vs Multi agent

a. Competitive Multi agent

b.Co – operative Multi agent

Define Omniscience.

An Omniscience agent knows the actual outcome of its actions and can act accordingly

How agent should act?

Agent should act as a rational agent. Rational agent is one that does the right thing, (i.e.) right actions will cause the agent to be most successful in the environment.

How to measure the performance of an agent?

Performance measure of an agent is got by analyzing two tasks. They are How and When actions.

Define Percept Sequence.

An agent’s choice of action at any given instant can depend on the entire percept sequence observed to elate.

What are the factors that a rational agent should depend on at any given time?

1. The performance measure that defines degree of success.

2. Ever thing that the agent has perceived so far. We will call this complete perceptual history the percept sequence.

3. When the agent knows about the environment.

4. The action that the agent can perform.

What is game playing?

The term Game means a sort of conflict in which n individuals or groups (known as players) participate. Game theory denotes games of strategy. Game theory allows decision-makers (players) to cope with other decision-makers (players) who have different purposes in mind. In other words, players determine their own strategies in terms of the strategies and goals of their opponent.

How Knowledge is represented?

A variety of ways of knowledge (facts) have been exploited in AI programs. Facts: truths in some relevant world. These are things we want to represent.

PROPOSITIONAL LOGIC

What is propositional logic?

It is a way of representing knowledge. In logic and mathematics, a propositional calculus or logic is a formal system in which formulae representing propositions can be formed by Combining atomic propositions using logical connectives. Sentences considered in propositional logic are not arbitrary sentences but are the ones that are either true or false, but not both. This kind of sentences are called propositions. Example Some facts in propositional logic: It is raning. - RAINING It is sunny - SUNNY It is windy - WINDY If it is raining ,then it is not sunny - RAINING -> SUNNY

What are the elements of propositional logic?

Simple sentences which are true or false are basic propositions. Larger and more complex sentences are constructed from basic propositions by combining them with connectives. Thus propositions and connectives are the basic elements of propositional logic. Though there are many connectives, we are going to use the following five basic connectiveshere:NOT, AND, OR, IF\_THEN(orIMPLY), IF\_AND\_ONLY\_IF. They are also denoted by the symbols: , , , , , respectively.

Define Generalized Modus ponens.

In Boolean logic, with the rule ``IF X is A THEN Y is B'', the proposition X is A has to be observed to consider the proposition Y is B. In fuzzy logic, a proposition ``X is '', close to the premise ``X is A'' can be observed to provide a conclusion ``Y is '' close to the conclusion ``Y is B ''. A simple fuzzy inference can be represented as: Rule : IF X is A THEN Y is B Fact : X is Conclusion : Y is B

Define Logic

Logic is one which consist of i. A formal system for describing states of affairs, consisting of a) Syntax b)Semantics. ii. Proof Theory – a set of rules for deducing the entailment of a set sentences

What is entailment?

Propositions tell about the notion of truth and it can be applied to logical reasoning. We can have logical entailment between sentences. This is known as entailment where a sentence follows logically from another sentence. In mathematical notation we write : alphta |=beta

Define First order Logic?

First-order logic (like natural language) assumes the world contains Objects: people, houses, numbers, colors, baseball games, wars, … Relations: red, round, prime, brother of, bigger than, part of, comes between, … Functions: father of, best friend, one more than, plus, …

What are quantifiers?

There is need to express properties of entire collections of objects,instead of enumerating the objects by name. Quantifiers let us do this. FOL contains two standard quantifiers called a) Universal () and b) Existential ()

Explain the connection between  and 

“Everyone likes icecream“ is equivalent”, “there is no one who does not like ice cream” This can be expressed as : x Likes(x,IceCream) is equivalent to  Likes(x,IceCream)

What are the levels in Structuring of knowledge?

(i) The knowledge level at which facts are described (ii)The symbol level at which representation of objects at knowledge level are defined in terms of symbols

What are the four properties for knowledge representation ?

Representational adequacy . Inferential adequacy . Inferential efficiency . Acquisitional efficiency

What is predicate calculus?

Predicate Calculus is a generalization of propositional calculus.Hence besides terms, predicates, and quantifiers, predicate calculus contains propositional variables, constants and connectives as part of the language

What is frame problem?

The whole problem of representing the facts, the change as well as those

that do not is known as frame problem

What are frames?

A frame is a collection of attributes and associated values that describe

some entity in the world.

Difference between Logic programming and PROLOG.

 In logic, variables are explicitly quantified. In PROLOG,

quantification is provided implicitly by the way the variables are

interpreted

 In logic, there are explicit symbols for and, or. In PROLOG,

there is an explicit symbol for and, but there is none for or

 In logic, implications of the form “p implies q” are written as p.

q . In PROLOG, the same implication is written “backward” as

q:-p .

For the given sentence “All Pompians were Romans” write a well

formed formula in predicate logic. [MAY / JUNE 2016]

x Pompian(x) => Roman(x)

Define FOL.

FOL is a first order logic. It is a representational language of knowledge

which is powerful than propositional logic (i.e.) Boolean Logic. It is an

expressive, declarative, compositional language

Define an inference procedure

An inference procedure reports whether or not a sentence is entiled by

knowledge base provided a knowledge base and a sentence .An inference

procedure ‘i’ can be described by the sentences that it can derive. If i can

derive from knowledge base, we can write. KB --Alpha is derived from

KB or i derives alpha from KB.

Define backward chaining.

This algorithm works backward from the goal, chaining through rules to

find known facts that support the proof.

In backward chaining,we start from a conclusion,which is the hypothesis we

wish to prove,and we aim to show how that conclusion can be reached from the

rules and facts in the data base.The conclusion we are aiming to prove is called a

goal and the reasoning in this way is known as goal-driven.

What is forward chaining? [APRIL/MAY 2017, APR/MAY 2018]

Using a deduction to reach a conclusion from a set of antecedents is called

forward chaining. In other words, the system starts from a set of facts,and a set of rules,and tries to find the way of using these rules and facts to deduce

a conclusion or come up with a suitable course of action. This is known as

data driven reasoning.

What are the basic Components of propositional logic?

i. Logical Constants (True, False)

What are the basic Components of propositional logic?

i. Logical Constants (True, False)

Define AND –Elimination rule in propositional logic

AND elimination rule states that from a given conjunction it is possible

to inference any of the conjuncts.

Define a Proof

A sequence of application of inference rules is called a proof. Finding

proof is exactly finding solution to search problems. If the successor

function is defined to generate all possible applications of inference rules

then the search algorithms can be applied to find proofs.

With an example, show objects, properties functions and relations.

Example “EVIL KING JOHN BROTHER OF RICHARD RULED

ENGLAND IN 1200”

Objects : John, Richard, England, 1200 Relation : Ruled Properties :

Evil, King Functions : BROTHER OF

Define a Sentence?

Each individual representation of facts is called a sentence. The

sentences are expressed in a language called as knowledge representation

language.

Define certainty factor?

A certainty factor (cf), a number to measure the expert’s belief. The

maximum value of the certainty factor is, say, +1.0 (definitely true) and

the minimum –1.0 (definitely false).For example, if the expert states that

some evidence is almost certainly true, a cf value of 0.8 would be

assigned to this evidence.

What is fuzzy logic?

• The term fuzzy logic is used in two senses:

– Narrow sense: Fuzzy logic is a branch of fuzzy set theory, which

deals (as logical systems do) with the representation and

inference from knowledge. Fuzzy logic, unlike other logical

systems, deals with imprecise or uncertain knowledge. In this

narrow and perhaps correct sense, fuzzy logic is just one of the

branches of fuzzy set theory.

– Broad Sense: fuzzy logic synonymously with fuzzy set theory