

## 2 MARKS QUESTION BANK WITH ANSWERS

### UNIT – 1

1(A). Define Artificial Intelligence (AI).

The study of how to make computers do things at which at the moment, people are better.

- Systems that think like humans
- Systems that act like humans
- Systems that think rationally
- Systems that act rationally

1(B). Define Artificial Intelligence formulated by Haugeland.

The exciting new effort to make computers think machines with minds in the full and literal sense.

1(C). Define Artificial Intelligence in terms of human performance.

The art of creating machines that performs functions that require intelligence when performed by people.

1(D). Define Artificial Intelligence in terms of rational acting.

A field of study that seeks to explain and emulate intelligent behaviors in terms of computational processes-Schalkoff. The branch of computer science that is concerned with the automation of intelligent behavior-Luger & Stubblefield.

1(E). Define Artificial in terms of rational thinking.

The study of mental faculties through the use of computational models-Charniak & McDermott. The study of the computations that make it possible to perceive, reason and act-Winston.

2. What is meant by Turing test?

To conduct this test we need two people and one machine. One person will be an interrogator (i.e.) questioner, will be asking questions to one person and one machine. Three of them will be in a separate room. Interrogator knows them just as A and B. so it has to identify which is the person and machine.

The goal of the machine is to make Interrogator believe that it is the person's answer. If machine succeeds by fooling Interrogator, the machine acts like a human. Programming a computer to pass Turing test is very difficult.

3. What is called materialism?

An alternative to dualism is materialism, which holds that the entire world operate according to physical law. Mental process and consciousness are therefore part of physical world, but inherently unknowable they are beyond rational understanding.

4. What are the capabilities, computer should possess to pass Turing test?

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

5. Define Total Turing Test?

The test which includes a video signals so that the interrogator can test the perceptual abilities of the machine.

6. What are the capabilities computers needs to pass total Turing test?

Computer Vision

Robotics

7. Define Rational Agent.

It is one that acts, so as to achieve the best outcome (or) when there is uncertainty, the best expected outcome.

8. Define Agent.

An Agent is anything that can be viewed as perceiving (i.e.) understanding its environment through sensors and acting upon that environment through actuators.

9. Define an Omniscient agent.

An omniscient agent knows the actual outcome of its action and can act accordingly; but omniscience is impossible in reality.

10. 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.

11. Define Architecture.

The action program will run on some sort of computing device which is called as Architecture

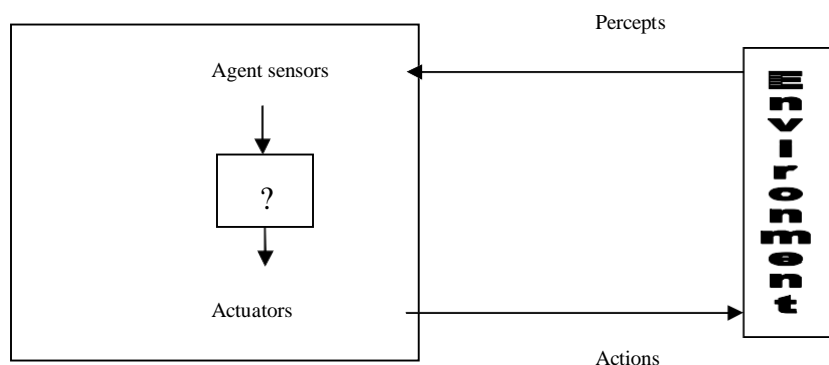
12. List the various type of agent program.

- Simple reflex agent program.
- Agent that keep track of the world.
- Goal based agent program.
- Utility based agent program

13. Give the structure of agent in an environment?

Agent interacts with environment through sensors and actuators.

An Agent is anything that can be viewed as perceiving (i.e.) understanding its environment through sensors and acting upon that environment through actuators.



14. Define Percept Sequence.

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

15. Define Agent Function.

It is a mathematical description which deals with the agent's behavior that maps the given percept sequence into an action.

16. Define Agent Program.

Agent function for an agent will be implemented by agent program.

17. 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.

18. 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.

19. Define performance measures.

Performance measure embodies the criterion for success of an agent's behavior.

20. Define Ideal 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.

21. Define Omniscience.

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

22. Define Information Gathering.

Doing actions in order to modify future percepts sometimes called information gathering.

23. What is autonomy?

A rational agent should be autonomous. It should learn what it can do to compensate for partial (or) in correct prior knowledge.

24. What is important for task environment?

PEAS → P- Performance measure  
E - Environment  
A- Actuators  
S – Sensors

Example

Interactive English tutor performance measure maximize student's score on test.

**Environment**

Set of students testing Agency

**Actuators**

Display exercises suggestions, corrections.

## Sensors

Keyboard entry

25. What is environment program?

It defines the relationship between agents and environments.

26. List the properties of environments.

- Fully Observable Vs Partially Observable
- Deterministic Vs Stochastic
- Episodic Vs Sequential
- Static Vs Dynamic
- Discrete Vs Continuous
- Single Agent Vs Multi agent
  - a. Competitive Multi agent
  - b. Co – operative Multi agent

27. What is Environment Class (EC) and Environment Generator (EG)?

EC – It is defined as a group of environment.

EG – It selects the environment from environment class in which the agent has to Run.

28. What is the structure of intelligent Agent?

Intelligent Agent = Architecture + Agent Program

29. 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.

30. List the steps involved in simple problem solving technique.

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

31. What are the different types of problem?

Single state problem, multiple state problems, Contingency problem, Exploration problem.

32. 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

33. Define State Space.

The set of all possible states reachable from the initial state by any sequence of action is called state space.

34. Define Path.

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

35. 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.

36. Give example problems for Artificial Intelligence.

- i. Toy problems
- ii. Real world problems

37. 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

38. Define search tree.

The tree which is constructed for the search process over the state space is called search tree.

39. Define search node.

The root of the search tree that is the initial state of the problem is called search node.

40. Define fringe.

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

41. List the performance measures of search strategies.

- i. Completeness
- ii. Optimality
- iii. Time complexity
- iv. Space complexity

42. Define branching factor (b).

The number of nodes which is connected to each of the node in search tree is called Branching factor.

43. Differentiate Blind Search and Heuristic Search.

Blind search	Heuristic search
i) No information about the path cost in the current state to goal state.  ii) Problem is solved with the information we which we know.   iii) Example a) Breadth first search b) Uniform cost search c) Depth first Search d) Depth limited search e) Iterative deepening search f) Bi – Directional Search	i) We have some information like minimum path caused to move  ii) Problem can be solved by the information which is already given.   iii) Example a) Best first search b) Greedy search c) A* search

44. Define Backtracking search.

The variant of depth first search called backtracking search. Only one successor is generated at a time rather than all successor, partially expanded node remembers which successor generate next is called Backtracking search.

45. Define Uniform cost search.

Uniform cost search expands the node 'n' with the lowest path cost instead of expanding the shallowest node.

46. Define Depth first search.

It expands the deepest node in the current fringe of the search tree.

47. Define depth limited search.

The problem of unbounded tress can be avoided by supplying depth limit 1(i.e.) nodes at depth 1 are treated as if they have no successors. This is called Depth Limited search.

## UNIT – I

1. What is informed search?

One that uses problem – specific knowledge beyond the definition of the problem itself and it can find solutions more efficiently than an uninformed strategy.

2. What is the use of QUEUING\_FN?

QUEUING\_FN inserts asset of elements into the queue. Different varieties of queuing fn produce different varieties of the search algorithm.

3. Mention the criteria for the evaluation of search strategy.

There are 4 criteria: Completeness, time complexity, space complexity, optimality

4. List the various search strategies.

- a. BFS
- b. Uniform cost search
- c. DFS
- d. Depth limited search
- e. Iterative deepening search
- f. Bidirectional search

5. List the various informed search strategy.

Best first search –greedy search ,A\* search

Memory bounded search-Iterative deepening A\*search -simplified memory

bounded

A\*search -Iterative improvement search –hill climbing -simulated annealing

6. What is Best First Search?

Best First Search is an instance of the general TREE SEARCH or GRAPH SEARCH algorithm in which a node is selected for expansion based on an evaluation function,  $f(n)$ .

7. Define Evaluation function,  $f(n)$ .

A node with the lowest evaluation is selected for expansion, because evaluation measures distance to the goal.

8. Define Heuristic function,  $h(n)$ .

$h(n)$  is defined as the estimated cost of the cheapest path from node  $n$  to a goal node.

9. Define Greedy Best First Search.

It expands the node that is closest to the goal (i.e.) to reach solution in a quicker way. It is done by using the heuristic function:  $f(n) = h(n)$ .

10. Define A\* search.

A\* search evaluates nodes by combining  $g(n)$ , the cost to reach the node and  $h(n)$ , the cost to get from the node to the goal.

$$f(n) = g(n) + h(n)$$

11. Define Admissible heuristic  $h(n)$ .

In A\* search, if it is optimal then,  $h(n)$  is an admissible heuristic which means  $h(n)$  never overestimates the cost to reach the goal.

12. What is triangle inequality?

It states that each side of a triangle cannot be longer than the sum of the other two sides of the triangle.

13. What are the 2 types of memory bounded heuristic algorithms?

- i. Recursive Best First Search(RBFS)
- ii. Memory bounded A\*(MA\*)

14. Differentiate BFS & DFS.

BFS means breath wise search. Space complexity is more. Do not give optimal solution Queuing fn is same as that of queue operator

DFS means depth wise search. Space complexity is less Gives optimal solution Queuing fn is somewhat different from queue operator.

15. What is RBFS?

It keeps track of the f-value of the best alternative path available from any ancestor of the current node. RBFS remembers the f-value of the best leaf in the forgotten sub tree and therefore decide whether its worth re expanding the sub tree sometimes later.

16. Define iterative deepening search.

Iterative deepening is a strategy that sidesteps the issue of choosing the best depth limit by trying all possible depth limits: first depth 0, then depth 1, then depth 2 & so on.

17. What are the 2 ways to use all available memory?

- i. Memory bounded  $A^*(MA^*)$
- ii. Simplified Memory bounded  $A^*(SMA^*)$

18. What is SMA\* search?

SMA\* expands the best leaf until memory is full and it drops the oldest worst leaf node and expands the newest best leaf node.

19. What is called as bidirectional search?

The idea behind bidirectional search is to simultaneously search both forward from the initial state & backward from the goal & stop when the two searches meet in the middle.

20. What is metalevel state space?

Each state in a metalevel state space captures the internal state of a program that is searching in an object level state space.

21. What is Manhattan distance,  $h_2$ ?

The sum of the horizontal and vertical distances of the tiles from their goal positions in a 15 puzzle problem is called Manhattan distance (or) city block distance.

22. Give the drawback of DFS.

The drawback of DFS is that it can get stuck going down the wrong path. Many problems have very deep or even infinite search tree. So dfs will never be able to recover from an unlucky choice at one of the nodes near the top of the tree. So DFS should be avoided for search trees with large or infinite maximum depths

23. Define Branching factor  $b^*$ .

Uniform tree of depth  $d$  would have to be in order to contain  $N+1$  nodes is called branching factor.

24. Write the time & space complexity associated with depth limited search.

Time complexity  $= O(bd)$ ,  
b-branching factor,  
d-depth of tree



Space complexity= $O(b^l)$

25. What is Relaxed problems?

A problem with fewer restrictions on the actions is called a relaxed problem.

26. What is a pattern database?

This database is the storage of exact solution costs for every possible sub problem instance.

27. What is a disjoint pattern database?

The sum of the two costs is still a lower bound on the cost of solving the entire problem is called a disjoint pattern database.

28. What is local search?

It operates using a single current state rather than multiple paths and generally moves only to neighbors of that state.

29. Define Optimization Problems.

The aim of this problem is to find the best state according to an objective function.

30. What are the 2 parts of Landscape?

- i. Location defined by the state.
- ii. Elevation defined by the value of the heuristic cost function (or) objective function.

31. Define Global minimum.

If elevation corresponds to cost, then the aim is to find the lowest valley is called global minimum.

32. Define Global Maximum.

If elevation corresponds to an objective function, then the aim is to find the highest peak is called global maximum.

33. Define Hill Climbing search.

It is a loop that continually moves in an increasing value direction (i.e.) up hill and terminates when it reaches a "peak" where no neighbor has a higher value.

34. List some drawbacks of hill climbing process.

Local maxima: A local maxima as opposed to a global maximum is a peak that is lower than the highest peak in the state space. Once a local maxima is reached the algorithm will halt even though the solution may be far from satisfactory.

Plateaux: A plateau is an area of the state space where the evaluation fn is essentially flat. The search will conduct a random walk.

35. What is the meaning for greedy local search?

It greedily picks a good neighbor state without thinking ahead about where to go next.

36. Define Local maxima.

A local maximum is a peak that is higher than each of its neighboring states, but lower than the global maximum.

37. What are the variants of hill climbing?

- i. Stochastic hill climbing
- ii. First choice hill climbing
- iii. Simulated annealing search
- iv. Local beam search
- v. Stochastic beam search

38. Define annealing.

Annealing is the process used to harden metals (or) glass by heating them to a high temperature and then gradually cooling them, thus allowing the material to coalesce into a low energy crystalline state.

39. Define simulated annealing.

This algorithm, instead of picking the best move, it picks a random move. If the move improves the situation, it is always accepted.

40. What is the advantage of memory bounded search techniques?

We can reduce space requirements of A\* with memory bounded algorithm such as IDA\* & SMA\*.

41. Give the procedure of IDA\* search.

Minimize  $f(n)=g(n)+h(n)$  combines the advantage of uniform cost search + greedy search A\* is complete, optimal. Its space complexity is still prohibitive. Iterative improvement algorithms keep only a single state in memory, but can get stuck on local maxima. In this algorithm each iteration is a dfs just as in regular iterative deepening. The depth first search is modified to use an f-cost limit rather than a depth limit. Thus each iteration expands all nodes inside the contour for the current f-cost.

42. List some properties of SMA\* search.

- \* It will utilize whatever memory is made available to it.
- \* It avoids repeated states as far as its memory allow.
- \* It is complete if the available memory is sufficient to store the shallowest path.
- \* It is optimal if enough memory is available to store the shallowest optimal solution path.

Otherwise it returns the best solution that can be reached with the available memory.

- \*When enough memory is available for entire search tree, the search is optimally efficient.
- \*Hill climbing.
- \*Simulated annealing.

43. What is Genetic Algorithms?

Genetic Algorithm is a variant of stochastic beam search in which successor states are generated by combining two parent states, rather than by modifying a single state.

44. Define Online Search agent.

Agent operates by interleaving computation and action (i.e.) first it takes an action, and then it observes the environment and computes the next action.

45. What are the things that agent knows in online search problems?

- a. Actions(s)
- b. Step cost function  $C(s, a, s')$
- c. Goal TEST(s)

46. Define CSP.

Constraint Satisfaction problem (CSP) is defined by a set of variables  $X_1, X_2, \dots, X_n$  and set of constraints  $C_1, C_2, \dots, C_m$ .

47. Define Successor function.

A value can be assigned to any unassigned variable, provided that does not conflict with previously assigned variables.

48. What are the types of constraints?

There are 5 types,

- a. Unary constraints relates one variable.
- b. A binary constraint relates two variables.
- c. Higher order constraints relate more than two variables.
- d. Absolute constraints.
- e. Preference constraints.

49. Define MRV.

Minimum remaining values heuristic chooses the variable with the fewest “legal” values.

50. Define LCV.

Least constraining value heuristic prefers the value that rules out the fewest choices for the neighboring variables in the constraint graph.

51. Define Conflict directed back jumping.

A back jumping algorithm that uses conflict sets defined in this way is called Conflict directed back jumping.

52. Define constraint propagation.

It is the general term for propagating (i.e.) spreading the implications of constraints on the variable on to other variable.

53. Define Cycle cut set.

The process of choosing a subset  $S$  from variables [CSP] such that the constraint graph becomes a tree after removal of  $S$ .  $S$  is called a cycle cut set.

54. Define Tree decomposition.

The constraint graph is divided into a set of connected sub problems. Each sub problem is solved independently and the resulting solutions are then combined. This process is called tree decomposition.

55. Define Alpha beta pruning.

Alpha beta pruning eliminates away branches that cannot possibly influence the final decision

## UNIT – I

### 1. 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.

### 2. Define a knowledge Base:

Knowledge base is the central component of knowledge base agent and it is described as a set of representations of facts about the world.

### 3. 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

### 4. Define a Sentence?

Each individual representation of facts is called a sentence. The sentences are expressed in a language called as knowledge representation language.

### 5. 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.

### 6. Define Ontological commitment.

The difference between propositional and first order logic is in the ontological commitment. It assumes about the nature of reality.

### 7. Define Epistemological commitment.

The logic that allows the possible states of knowledge with respect to each fact.

### 8. Define domain and domain elements.

The set of objects is called domain, sometimes these objects are referred as domain elements.

### 9. What are the three levels in describing knowledge based agent?

- Logical level
- Implementation level
- Knowledge level or epistemological level

### 10. Define Syntax?

Syntax is the arrangement of words. Syntax of a knowledge describes the possible configurations that can constitute sentences. Syntax of the language describes how to make sentences.

### 11. Define Semantics

The semantics of the language defines the truth of each sentence with respect to each possible world. With this semantics, when a particular configuration exists within an agent, the agent believes the corresponding sentence.

12. Define Logic

Logic is one which consists 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 of sentences.

13. What are the 3 types of symbols which are used to indicate objects, relations and functions?

- i) Constant symbols for objects
- ii) Predicate symbols for relations
- iii) Function symbols for functions

14. Define terms.

A term is a logical expression that refers to an object. We use 3 symbols to build a term.

15. Define Atomic sentence.

Atomic sentence is formed by both objects and relations.

Example

Brother (William, Richard)

William is the brother of Richard.

16. Define Quantifier and its types.

Quantifiers are used to express properties of entire collection of objects rather than representing the objects by name.

Types:

- i. Universal Quantifier
- ii. Existential Quantifier
- iii. Nested Quantifier.

17. What are the two we use to query and answer in knowledge base?

ASK and TELL.

18. Define kinship domain.

The domain of family relationship is called kinship domain which consists of objects unary predicate, binary predicate, function, relation.

19. Define syntactic sugar.

Extension to the standard syntax (i.e.) procedure that does not change the semantics (i.e.) meaning is called syntactic sugar.

20. Define synchronic and diachronic sentence.

Sentences dealing with same time are called synchronic sentences. Sentences that allow reasoning “a cross time” are called diachronic sentence.

21. What are the 2 types of synchronic rules?

- i. Diagnostic rules

ii. Casual rules.

22. Define skolem constant.

The existential sentence says there is some object satisfying a condition, and the instantiation process is just giving a name to that object. That name must not belong to another object. The new name is called skolem constant.

23. What is truth Preserving

An inference algorithm that derives only entailed sentences is called sound or truth preserving

24 .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.

25. Define a Complete inference procedure

An inference procedure is complete if it can derive all true conditions from a set of premises.

26. Define Interpretation

Interpretation specifies exactly which objects, relations and functions are referred to by the constant predicate, and function symbols.

27. Define Validity of a sentence

A sentence is valid or necessarily true if and only if it is true under all possible interpretation in all possible world.

28. Define Satisfiability of a sentence

A sentence is satisfiable if and only if there is some interpretation in some world for which it is true

29. Define true sentence

A sentence is true under a particular interpretation if the state of affairs it represents is the case.

30. What are the basic Components of propositional logic?

i. Logical Constants (True, False)

31 .Define Modus Ponens's rule in Propositional logic?

The standard patterns of inference that can be applied to derive chains of conclusions that lead to the desired goal is said to be Modus Ponens's rule.

32 .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.

OR-Introduction rule states that from, a sentence, we can infer its disjunction with anything.

35. Define Unification.

Lifted Inference rule require finding substitutions that make different logical expressions look identical (same). This is called Unification.

36. Define Occur check.

When matching a variable in 2 expressions against a complex term, one must check whether the variable itself occurs inside the term, If it does the match fails. This is called occur check.

37. Define pattern matching.

The inner loop of an algorithm involves finding all the possible unifiers with facts in the KB. This is called pattern matching.

38. Explain the function of Rete Algorithm?

This algorithm preprocess the set of rules in KB to constant a sort of data flow network in which each node is a literals from rule a premise.

39. Define magic set.

To rewrite the rule set, using information from the goal, so that only relevant variable bindings called magic set.

40. Define backward chaining.

This algorithm works backward from the goal, chaining through rules to find known facts that support the proof.

41. Define Prolog program.

It is a set of definite clauses written in a notation somewhat different from standard FOL.

42. What are the divisions of knowledge in OTTER theorem?

- i. Set of Support (SOS)
- ii. Usable axioms
- iii. Rewrites (or) Demodulators
- iv. A set of parameters and sentences

43. What are the 2 types of frame problem?

- i. Representational Frame Problem
- ii. Inferential Frame Problem

44. What are the 2 types of processes?

- i. Discrete events – it have definite structure
- ii. Liquid events - Categories of events with process.

45. Define fluent calculus.

Discard Situation Calculus and invent a new formalism for writing axioms is Called Fluent Calculus.

46. What is important for agent?

Time (i.e.) intervals is important for agent to take an action.

There are 2 kinds;

- i. Moments
- ii. Extended Intervals

47. Define runtime variables.

Plans to gather and use information are represented using short hand  
Notation called runtime variables (n).

Example

[Look up (Agent, "Phone number (Divya)".N), Dial (n)]

## UNIT – I

1. Why does uncertainty arise ?

- ☐ Agents almost never have access to the whole truth about their environment.
- ☐ Agents cannot find a categorical answer.
- ☐ Uncertainty can also arise because of incompleteness, incorrectness in agents understanding of properties of environment.

2. State the reason why first order, logic fails to cope with that the mind like medical diagnosis.

Three reasons

- ☐ a. laziness: o it is hard to list complete set of antecedents of consequence, needed to ensure and exceptionless rule.
- ☐ b. Theoretical Ignorance: o medical science has no complete theory for the domain.
- ☐ Practical ignorance: even if we know all the rules, we may be uncertain about a particular item needed.

3. Define the term utility?

The term utility is used in the sense of "the quality of being useful .", utility of a state is relative to the agents, whose preferences the utility function is supposed to represent.

4. What is the need for probability theory in uncertainty ?

Probability provides the way of summarizing the uncertainty that comes from our laziness and ignorance . Probability statements do not have quite the same kind of semantics known as evidences.

5. what is the need for utility theory in uncertainty?

Utility theory says that every state has a degree of usefulness, or utility to in agent, and that the agent will prefer states with higher utility. The use utility theory to represent and reason with preferences.

6. What is called as principle of maximum expected utility ?

The basic idea is that an agent is rational if and only if it chooses the action that yields the highest expected utility, averaged over all the possible outcomes of the action. This is known as MEU.

7. What Is Called As Decision Theory ?

Preferences As Expressed by Utilities Are Combined with Probabilities in the General Theory of Rational Decisions Called Decision Theory.

Decision Theory = Probability Theory + Utility Theory.

8. Define Prior Probability?

$p(a)$  for the Unconditional or Prior Probability Is That the Proposition A is True. It is important to remember that  $p(a)$  can only be used when there is no other information.



9. Define conditional probability?

Once the agents has obtained some evidence concerning the previously unknown propositions making up the domain conditional or posterior probabilities with the notation  $p(A/B)$  is used. This is important that  $p(A/B)$  can only be used when all be is known.

10. Define probability distribution:

Eg.  $P(\text{weather}) = (0.7, 0.2, 0.08, 0.02)$ . This type of notations simplifies many equations.

11. What is an atomic event?

An atomic event is an assignment of particular values to all variables, in other words, the complete specifications of the state of domain.

12. Define joint probability distribution

This completely specifies an agent's probability assignments to all propositions in the domain. The joint probability distribution  $p(x_1, x_2, \dots, x_n)$  assigns probabilities to all possible atomic events; where  $X_1, X_2, \dots, X_n$  are variables.

13. Give the Baye's rule equation

$$\text{W.K.T } P(A \wedge B) = P(A/B) P(B) \text{-----} 1$$

$$P(A \wedge B) = P(B/A) P(A) \text{-----} 2$$

DIVIDING BY  $P(A)$  ;

WE GET

$$P(B/A) = P(A/B) P(B) \text{-----} P(A)$$

14. What is meant by belief network?

A belief network is a graph in which the following holds

- ☐ A set of random variables
- ☐ A set of directive links or arrows connects pairs of nodes.
- ☐ The conditional probability table for each node
- ☐ The graph has no directed cycles.

15. What are the ways in which one can understand the semantics of a belief network?

There are two ways to see the network as a representation of the joint probability distribution to view it as an encoding of collection of conditional independence statements.

16. What is the basic task of a probabilistic inference?

The basic task is to reason in terms of prior probabilities of conjunctions, but for the most part, we will use conditional probabilities as a vehicle for probabilistic inference.

17. What are called as Poly trees?

The algorithm that works only on singly connected networks known as Poly trees. Here at most one undirected path between any two nodes is present.

18. Define casual support

$E \rightarrow X$  is the casual support for  $X$ - the evidence variables "above"  $X$  that are connected to  $X$  through its parent.

19. Define evidential support

E-X is the evidential support for X- the evidence variables "below" X that are connected to X through its children.

20. What is called as multiple connected graph?

A multiple connected graph is one in which two nodes are connected by more than one path.

21. What is the purpose of learning?

The idea behind learning is that percepts should be used not only for acting but also for improving the agent's ability to act in the future.

22. What are issues in learning element?

- i. Component
- ii. Feedback
- iii. Representation

23. What are the types of machine learning?

- i. Supervised Learning
- ii. Unsupervised Learning
- iii. Reinforcement Learning

24. Differentiate Supervised and Unsupervised learning.

Supervised Learning	Unsupervised Learning
It involves learning a function From examples of its inputs And outputs	It involves learning patterns in the input when no specific output values are supplied.
Example: Applying Brake on the wet road, we can even skip on the road is a result.	Example: Day by day agent will learn about "Good traffic days" and "Bad traffic days" without any advice.

25. Define Reinforcement Learning.

This Learning is rather than being told what to do by teacher, a reinforcement learning agent must learn from occasional rewards.

Example

If taxi driver does not get a tip at the end of journey, it gives him a indication that his behaviour is undesirable.

26. Define Inductive Learning.

An algorithm for supervised learning is given as input the correct value of the unknown function for particular inputs and it must try to recover the unknown function.

27. Define Classification Learning.

Learning a discrete valued function is called is called classification learning.

28. Define Regression learning.

Learning a continuous valued function is called regression learning.

29. What is parity and majority function?

Parity Function : It Returns 1 if and only if an even number of inputs are 1.

Majority function : It Returns 1 if more than half of its inputs are 1.

30. What is training set?

The complete set of examples is called the training set.

Example

Restaurant problem

Goal predicate "will wait"

31. Define Information gain.

Information gain from the attribute test is the difference between the original information requirement and the new requirement.

$$\text{Gain}(A) = I(p/(p+n)), n/(p+n) - \text{Remainder}(A)$$

32. What is test set?

Prediction is good if it turns out to be true, so can assess quality of hypotheses by

Checking its predictions against the correct classification once we know it. We do this on a set of examples is known as Test Set.

33. What is over fitting?

Whenever there is a large set of possible hypotheses, one has to be careful not to use the resulting freedom to find meaningless "regularity" in the data. This problem is called over fitting.

34. What is the purpose of cross validation?

It reduces over fitting. It can be applied to any learning algorithm, not just decision tree learning. The basic idea is to estimate how well each hypotheses will predict unseen data.

35. Mention the exercises which broaden the applications of decision trees.

- i. Missing data
- ii. Multivalued attributes
- iii. Continuous and integer valued input attributes
- iv. Continuous valued output attributes.

36. What is ensemble learning?

The idea of this learning is to select a whole collection or ensemble, of hypotheses from the hypotheses space and combine their predictions.

37. Define PAC – Learning Algorithm.

An learning algorithm that return hypotheses that are approximately correct is called PAC learning algorithm.

38. Define Decision list.

It is a logical expression of a restricted form, It consists of a series of tests, each of which conjunction of literals. If test succeeds, value is returned. If test fails, processing continues with the next test in the list.

39. What is the purpose of current best hypotheses search?

This search is to maintain a single hypothesis and to adjust it as new examples arrive in order to maintain consistency.

40. Differentiate generalization and specialization.

The extension of the hypotheses must be increased to include it. This is called generalization.

The extension of the hypotheses must be decreased to exclude the example. This is called specialization.

41. Define Boundary set.

Each boundary will not be a point but rather a set of hypotheses called a Boundary set.

42. What are the two boundary sets?

i. G Set : a most general boundary set.

ii. S Set : a most specific boundary set.

43. Show the relationship of an entailment constraint.

$\text{Hypothesis} \wedge \text{Descriptions} \models \text{classifications}$

44. Define EBL.

Explanation based learning, from the prior knowledge (or) information; we can infer a general rule. This kind of generalization process called explanation based learning (or) EBL.

45. What is the entailment constraints satisfied by EBL?

$\text{Hypothesis} \wedge \text{Description} \models \text{classification}$

$\text{Background} \models \text{Hypothesis}$

46. Define RBL.

Relevance based Learning; the prior knowledge background concerns the relevance of a set of features to the goal predicate. This knowledge together with the observations, Allows the agent to infer a new, general rule that explains the observations.

$\text{Hypothesis} \wedge \text{Description} \models \text{classifications},$

$\text{Background} \wedge \text{Description} \wedge \text{classifications} \models \text{Hypothesis}.$

47. Define knowledge based Inductive learning.

KBIL algorithm finds inductive hypotheses that explain sets of observations with the help of background knowledge.

48. Define Inductive Logic Programming (ILP).

ILP techniques perform KBIL on knowledge that is expressed in first order logic. ILP methods can learn relational knowledge that is not expressible in attribute based systems.

49. What is the purpose of memorization?

Memorization used in computer science to speed up programs by saving the results of computation. The basic idea of memo function is to accumulate a database of input and output pairs, when the function is called; it first checks the database to see whether it can avoid solving the problem.

50. What is the basic EBL process step?
- Construct a proof using the available background knowledge.
  - Construct a generalized proof tree for the variabilized goal using the same inference steps as in the original proof.
  - Construct a new rule where LHS consists of the leaves of the proof tree and R.H.S is the variabilized goal.
  - Drop any conditions that are true.
51. Define constructive induction algorithm.  
Algorithms that can generate new predicates are called constructive induction algorithms.
52. What are the two main subroutines used for generating literals?
- NEW – LITERALS
  - CHOOSE - LITERALS
53. What are the 3 kinds of literals that can be added?
- Literals using Predicate
  - Equality and inequality literals
  - Arithmetic comparisons
54. Define Bayesian Learning.  
It calculates the probability of each hypotheses, given the data and makes predictions on that basis, (i.e.) predictions are made by using all the hypotheses, weighted by their probabilities rather than by using just single “best” hypotheses.
55. Define MAP.  
Maximum A Posteriori. A very common approximation is to make predictions based on single most probable hypotheses. This is MAP.
56. Define MDL.  
The MDL (Maximum Description Length), is a learning method which attempts to minimize the size of the hypotheses and data encodings rather than work with probabilities.
57. What is Maximum – Likelihood hypotheses?  
ML – it is reasonable approach when there is no reason to prefer one hypotheses over another a prior.
58. What are the methods for maximum likelihood parameter learning?
- Write down an expression for the likelihood of the data as a function of the parameter.
  - Write down the derivative of the log likelihood with respect to each parameter.
  - Find the parameter values such that the derivatives are zero.
59. Define Naïve Bayes model.  
In this model, the “class” variable  $C$  is the root and the “attribute” variable  $X_i$  are the leaves. This model assumes that the attributes are conditionally independent of each other, given the class.
60. Define sum of squared errors.  
The difference between the actual value  $y_j$  and the predicated value  $(\theta_1 x_j + \theta_2)$  so  $E$  is the sum of squared errors.

61. Define EM.

Expectation Maximization: the idea of EM is to pretend that we know the parameters of the model and then to infer the probability that each data point belongs to each component. After that we refit the components to the data, where each component is fitted to the entire data set with each point weighted by the probability.

62. What are the 2 steps in mixture model parameters?

- i. E – Step
- ii. M – Step

63. Define Neural Networks.

It consists of nodes or units connected by directed links. A link propagates the activation. Each link has a numeric weight which determines the strength and sign of the connection.

64. Give Activation function.

$$a_i = g(in_i) = g\left(\sum_{j=0}^n W_{j,i} a_j\right)$$

65. What are the two functions in Neural network's Activation functions?

- i. Threshold function
- ii. Sigmoid function

66. What are the categories of neural network structures?

- i. Acyclic (or) Feed – forward networks
- ii. Cyclic (or) Recurrent Networks

67. What is single layer feed forward neural network?

A network with all the inputs connected directly to the outputs is called a single layer neural network or a perceptron networks.

68. What is multilayer feed forward neural networks?

It consists of many hidden units. Each hidden unit act as a perceptron that represents a soft threshold functions in the input space. Output unit act as a soft threshold linear combination of several such functions.

69. Define Passive learning.

The agent's policy is fixed and the task is to learn the utilities of states, this could also involve learning a model of the environment.

70. Define Active Learning.

The agent must learn what to do. An agent must experience as much as possible of its environment in order to learn how to behave in it.

71. Define TD.

Temporal Difference learning: The key of TD is to use the observed transitions to adjust the values of the observed states so that they agree with the constraint equations.

## UNIT – 1

1. Define planning.

Planning can be viewed as a type of problem solving in which the agent uses beliefs about actions and their consequences to search for a solution.

2. What are the features of an ideal planner?

- i. The planner should be able to represent the states, goals and actions.
- ii. The planner should be able to add new actions at any time.
- iii. The planner should be able to use Divide and Conquer method for solving very big problems.

3. What are the components that are needed for representing an action?

The components that are needed for representing an action are: Action description. Precondition. Effect.

4. What are the components that are needed for representing a plan?

The components that are needed for representing a plan are: A set of plans steps. A set of ordering constraints.

5. What are the different types of planning?

The different types of planning are as follows:

- i. Situation space planning.
- ii. Progressive planning.
- iii. Regressive planning.
- iv. Partial order planning.
- v. Fully instantiated planning.

6. What are the ways in which incomplete and incorrect information's can be handled in planning?

They can be handled with the help of two planning agents namely,

- i. Conditional planning agent.
- ii. Replanning agent.

7. Define a solution.

A solution is defined as a plan that an agent can execute and that guarantees the achievement of goal.

8. Define a complete plan.

A complete plan is one in which every precondition of every step is achieved by some other step.

9. Define a consistent plan.

A consistent plan is one in which there are no contradictions in the ordering or binding constraints.

10. Define conditional planning.

Conditional planning is a way in which the incompleteness of information is incorporated in terms of adding a conditional step, which involves if – then rules.

11. Give the classification of learning process.

The learning process can be classified as:

Process which is based on coupling new information to previously acquired knowledge

- a. Learning by analyzing differences.
- b. Learning by managing models.
- c. Learning by correcting mistakes.
- d. Learning by explaining experience.

Process which is based on digging useful regularity out of data, usually called as Data base mining:

- a. Learning by recording cases.
- b. Learning by building identification trees.
- c. Learning by training neural networks.

12. What is Induction heuristics?

Descriptions from positive and negative examples.

13. What are the different types of induction heuristics?

There are two different types of induction heuristics. They are:

- i. Require-link heuristics.
- ii. Forbid-link heuristics.

14. What are the principles that are followed by any learning procedure?

- i. The wait and see principle.
- ii. The no altering principle.
- iii. Martin's law.

15. State the wait and see principle.

The law states that, "When there is doubt about what to do, do nothing"

16. State the no altering principle.

The law states that, " When an object or situation known to be an example, fails to match a general model, create a special case exception model".

17. State Martin's law.

The law states that, " You cannot learn anything unless you almost know it already".

18. Define Similarity nets.

Similarity net is an approach for arranging models. Similarity net is a representation in which nodes denotes models, links connect similar models and links are tied to different descriptions.

19. Define Reification.

The process of treating something abstract and difficult to talk about as though it were concrete and easy to talk about is called as reification.

20. What is reified link?

The elevation of a link to the status of a describable node is a kind of reification. When a link is so elevated then it is said to be a reified link.

21. Define Communication.



Communication is the international exchange of information brought about by the production and perception of signs drawn from a shared system of conventional signs.

22. Define Language.

Language enables us to communicate most of what we have observed about the environment.

23. Define Formal Language.

A formal language is defined as a set of strings of terminal symbols. It is called as words.

24. What are the processes in communication?

- i. Intention
- ii. Generation
- iii. Synthesis
- iv. Perception
- v. Analysis
- vi Disambiguation
- vii. Incorporation

25. What are the parts in analyze?

- i. Syntactic Interpretation
- ii. Semantic Interpretation
- iii. Pragmatic Interpretation

26. Define Semantic Interpretation.

The process of extracting the meaning of an utterance an expression in some representation language.

27. What are the processes of Relative clause.

- i. Generating Good English sentences
- ii. Over generation
- iii. Under generation

28. Define Parsing.

Parsing is the process of finding a parse tree for a given input string. It is also known as syntactic analysis.

29. What are the types of parsing?

- i. Top down parsing
- ii. Bottom up parsing

30. Define Top down parsing.

It starts with root node S and search for a tree that has the words as it leaves.

31. Define Bottom up parsing.

We start from the leaf nodes (i.e.) with the words and search for a tree with root S.

32. What are the algorithms to have efficient parsing?

- i. Left to right parsing algorithm
- ii. Chart Parsing algorithm.
- iii. Left corner parsing

33. Define Augmentation.

The process of adding the existing rules of a grammar instead of introducing new rules. It is called Augmentation.

34. Define DCG.

The method of rewriting the existing rules in the grammar by the method of augmentation is called as DCG (Define Clause Grammar).

35. Define Sub categorization.

E<sub>2</sub> eliminates VP by mentioning which phrases can allow which verbs which are known as sub categorization.

36. Define Ambiguity.

The sentence that does not provide exact meaning are called ambiguous sentence.

37. What are the types of Ambiguity?

- i. Lexical Ambiguity
- ii. Syntactic Ambiguity
- iii. Semantic Ambiguity

38. Define Disambiguation.

The speaker's aim is to communicate some words in utterance and hearer work is to get back the meaning of the world from the knowledge of situation.

39. Define Discourse understanding.

A discourse is any string of language usually one that is more than one sentence long.

40. What are the two sub problems in discourse understanding?

- i. Reference Resolution
- ii. The structure of coherent discourse.

41. What are the tasks in probabilistic language model?

- i. Information retrieval
- ii. Information Extraction
- iii. Machine Translation

42. What are the types of smoothing?

- i. Add one smoothing.
- ii. Linear Interpolation Smoothing

43. Define Segmentation?

The process of finding the words boundaries in a text with no spaces.

44. Define Information Retrieval (IR).

IR is the task of finding documents that are relevant to user's need for information.

45. What are the characteristics of IR?

- i. A document collection.

- ii. A query posed in a query language.
- iii. A result set
- iv. A presentation of the result set.

46. What are the types of evaluation of IR systems?

- i. Recall
- ii. Precision

47. What are the methods to do IR Refinements?

- i. Case folding
- ii. Stemming
- iii. Recognize synonyms
- iv. Spelling correction
- v. Meta data

48. What are the 3 mechanism to achieve performance improvement?

- i. Relevance feedback
- ii. Document classification
- iii. Document clustering

49. What are the types of clustering technique?

- i. Agglomerative clustering
- ii. K-means clustering

50. What are the two data structures that make IR systems efficient?

- i. Lexicon
- ii. Inverted Index

51. Define Information Extraction.

It is a process of creating database entries by skimming a text and looking for occurrences of a particular class of object.

52. What are the types of information extraction systems?

- i. Attribute based system
- ii. Relational based system

53. What are the stages in Relational based systems?

- i. tokenization
- ii. Complex word handling
- iii. Basic groups
- iv. Complex phrases
- v. Merges structures

54. What are the types of machine translation?

- i. Rough translation
- ii. Restricted source translation
- iii. Pre edited translation
- iv. Literacy translation

55. How to use the parameters for machine translation?

- i. Segment into sentences
- ii. Estimate the French language model
- iii. Align sentences
- iv. Estimate the initial fertility model
- v. Estimate the initial word choice model
- vi. Estimate the initial offset model
- vii. Improve all the estimates.