

## Introduction to Artificial Intelligence (20 Hours)

- **Session 1-5:**

- o Definition of Artificial Intelligence
- o Understanding AI
- o Different types of AI and main domains of AI technology

- **Session 6-10:**

- o History of AI
- o AI Uses
- o Various applications of AI

- **Session 11-13:**

- o Advantages and disadvantages associated with Artificial Intelligence

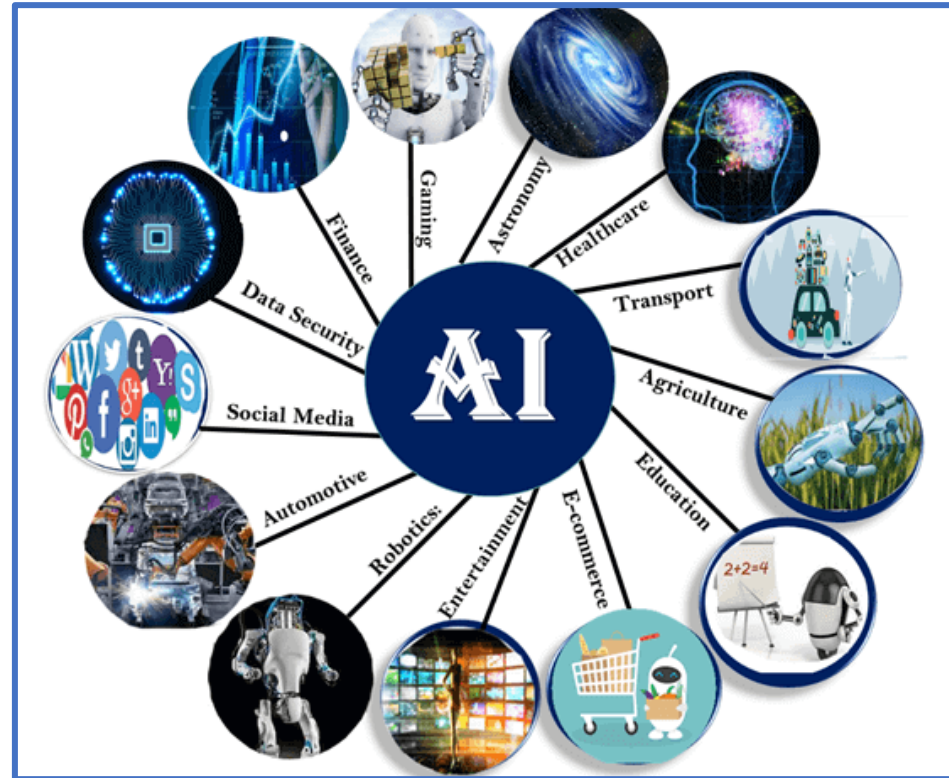
- **Session 14-16:**

- o Learn about the basics of Neural Networks, Fuzzy Logic and Genetic Algorithms

- **Session 17-20:**

- o Current trends and future directions in AI

Artificial Intelligence is composed of two words Artificial and Intelligence, where Artificial defines "man-made," and intelligence defines "thinking power", hence AI means "a man-made thinking power."

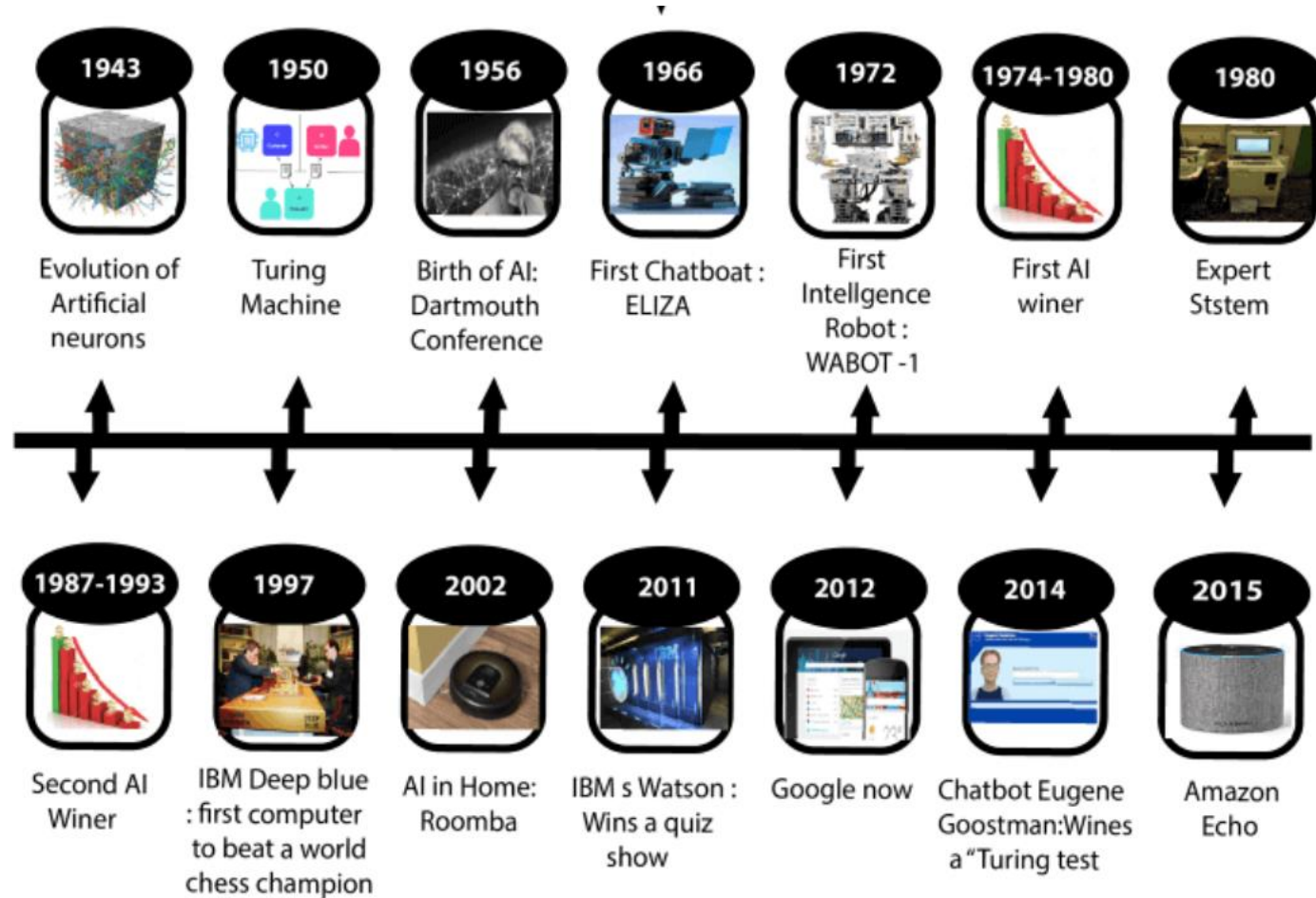


Application of AI

Year 1956

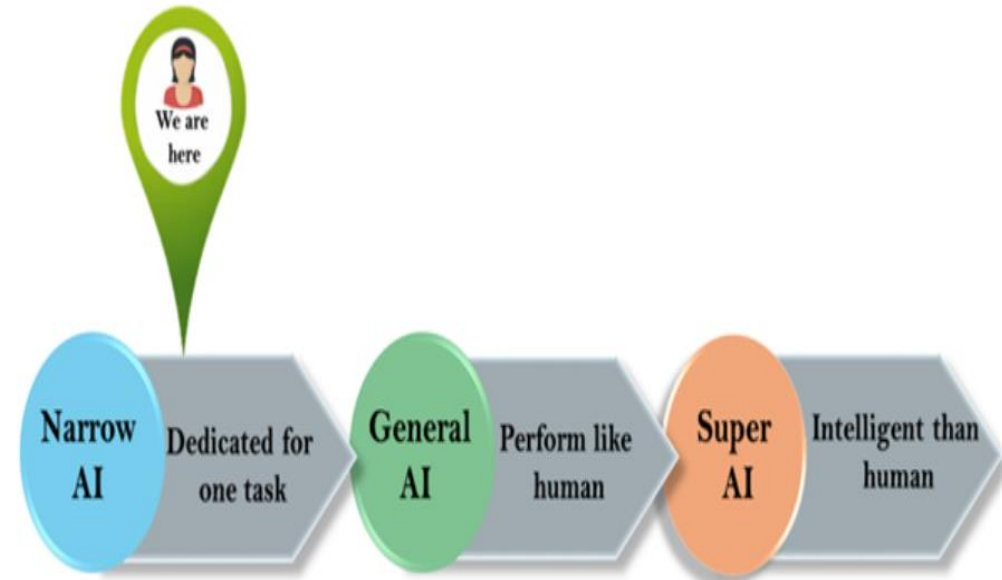
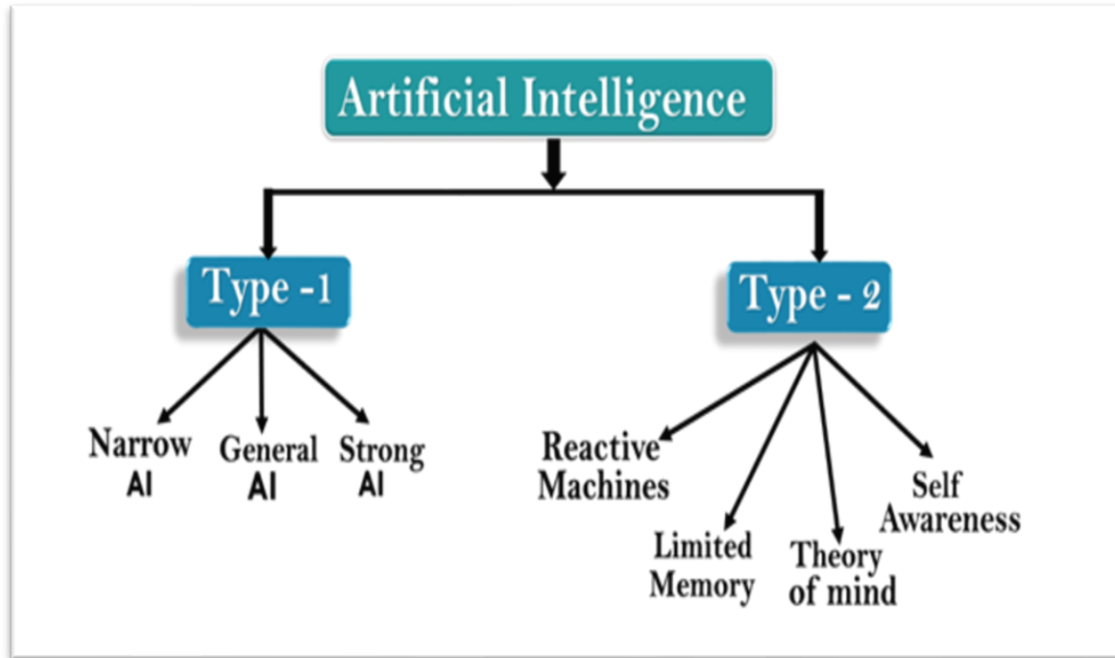
first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field.

# History of Artificial Intelligence



## Types of Artificial Intelligence

Artificial Intelligence can be divided in various types, there are mainly two types of main categorization which are based on capabilities and based on functionality of AI. Following is flow diagram which explain the types of AI.



### Narrow or Weak AI

Narrow AI cannot perform beyond its field or limitations, as it is only trained for one specific task. Hence it is also termed as weak AI. Narrow AI can fail in unpredictable ways if it goes beyond its limits.

Some Examples of Narrow AI are playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, and image recognition.

### General AI

- General AI is a type of intelligence which could perform any intellectual task with efficiency like a human.
- Currently, there is no such system exist which could come under general AI and can perform any task as perfect as a human.

### Super AI

Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. It is an outcome of general AI.

Some key characteristics of strong AI include capability include the ability to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own.

## Advantages of Artificial Intelligence

Following are some main advantages of Artificial Intelligence:

**High Accuracy with less errors:** AI machines or systems are prone to less errors and high accuracy as it takes decisions as per pre-experience or information.

**High-Speed:** AI systems can be of very high-speed and fast-decision making, because of that AI systems can beat a chess champion in the Chess game.

**High reliability:** AI machines are highly reliable and can perform the same action multiple times with high accuracy.

**Useful for risky areas:** AI machines can be helpful in situations such as defusing a bomb, exploring the ocean floor, where to employ a human can be risky.

**Digital Assistant:** AI can be very useful to provide digital assistant to the users such as AI technology is currently used by various E-commerce websites to show the products as per customer requirement.

**Useful as a public utility:** AI can be very useful for public utilities such as a self-driving car which can make our journey safer and hassle-free, facial recognition for security purpose, Natural language processing to communicate with the human in human-language, etc.

## Disadvantages of Artificial Intelligence

Every technology has some disadvantages, and the same goes for Artificial intelligence. Being so advantageous technology still, it has some disadvantages which we need to keep in our mind while creating an AI system. Following are the disadvantages of AI:

**High Cost:** The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.

**Can't think out of the box:** Even we are making smarter machines with AI, but still they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.

**No feelings and emotions:** AI machines can be an outstanding performer, but still it does not have the feeling so it cannot make any kind of emotional attachment with human, and may sometime be harmful for users if the proper care is not taken.

• **Increase dependency on machines:** With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.

• **No Original Creativity:** As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

## **Goals of Artificial Intelligence**

**Following are the main goals of Artificial Intelligence:**

**Replicate human intelligence**

**Solve Knowledge-intensive tasks**

**An intelligent connection of perception and action**

**Building a machine which can perform tasks that requires human intelligence such as:**

**Proving a theorem**

**Playing chess**

**Plan some surgical operation**

**Driving a car in traffic**



## What is an Agent?

An agent can be anything that perceives its environment through sensors and act upon that environment through actuators. An Agent runs in the cycle of perceiving, thinking, and acting. An agent can be:

**Human-Agent:** A human agent has eyes, ears, and other organs which work for sensors and hand, legs, vocal tract work for actuators.

**Robotic Agent:** A robotic agent can have cameras, infrared range finder, NLP for sensors and various motors for actuators.

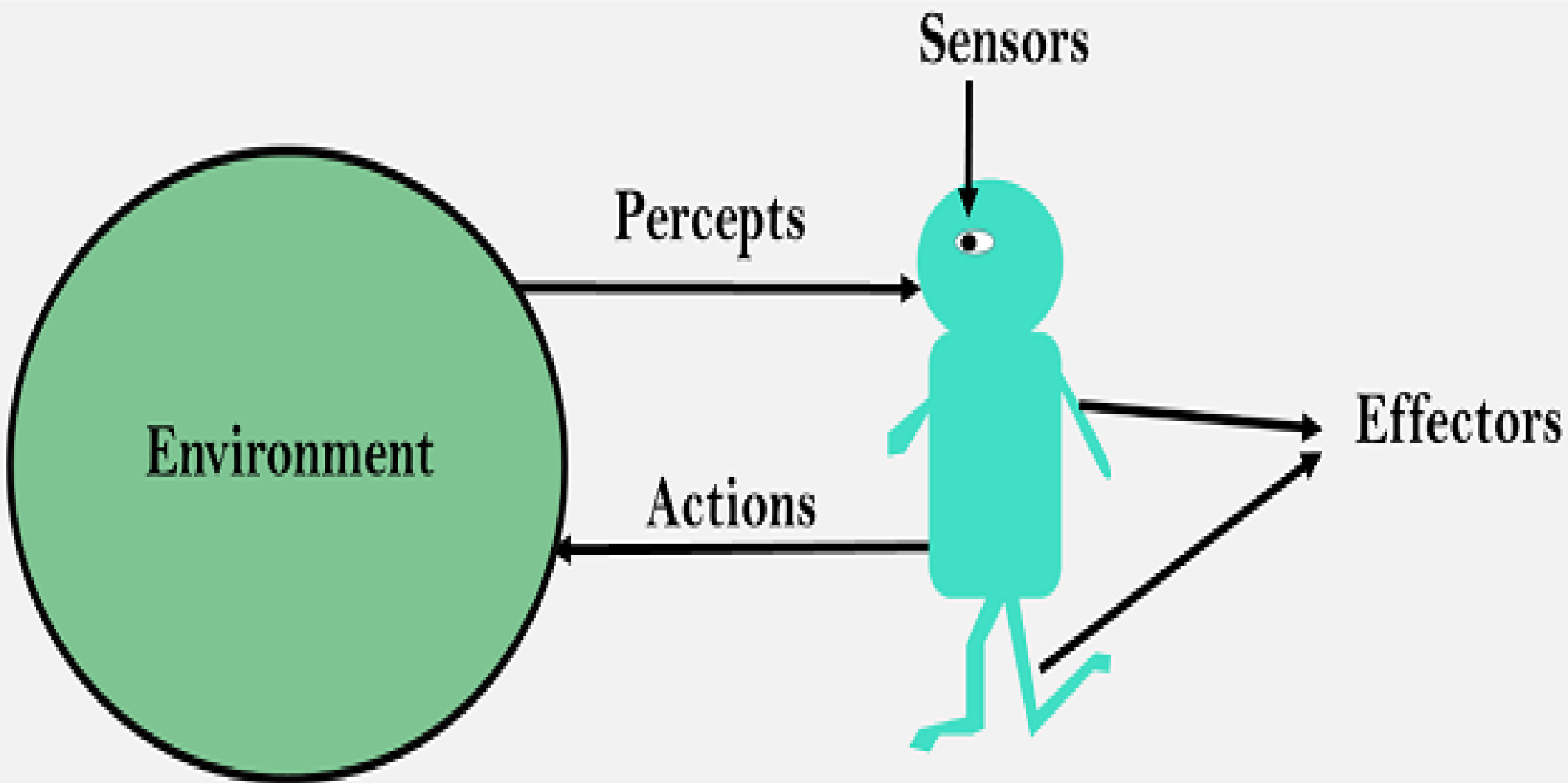
**Software Agent:** Software agent can have keystrokes, file contents as sensory input and act on those inputs and display output on the screen

Hence the world around us is full of agents such as thermostat, cellphone, camera, and even we are also agents. Before moving forward, we should first know about sensors, effectors, and actuators.

**Sensor:** Sensor is a device which detects the change in the environment and sends the information to other electronic devices. An agent observes its environment through sensors.

**Actuators:** Actuators are the component of machines that convert energy into motion. The actuators are only responsible for moving and controlling a system. An actuator can be an electric motor, gears, rails, etc.

**Effectors:** Effectors are the devices which affect the environment. Effectors can be legs, wheels, arms, fingers, wings, fins, and display screen.



## Uninformed Searching

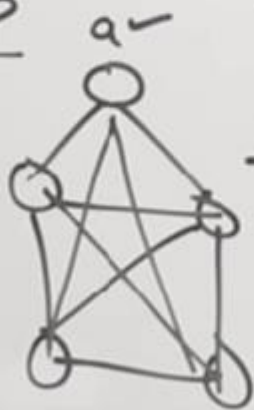
- 1) Search without Information
- 2) No knowledge
- 3) Time Consuming
- 4) More Complexity (Time, Space)
- 5) DFS, BFS, etc.



TSP

$$\frac{(n-1)!}{(5-1)!}$$

$4 = 24$



NP

$$\frac{24}{24} = 1$$

Optimality

## Informed Searching

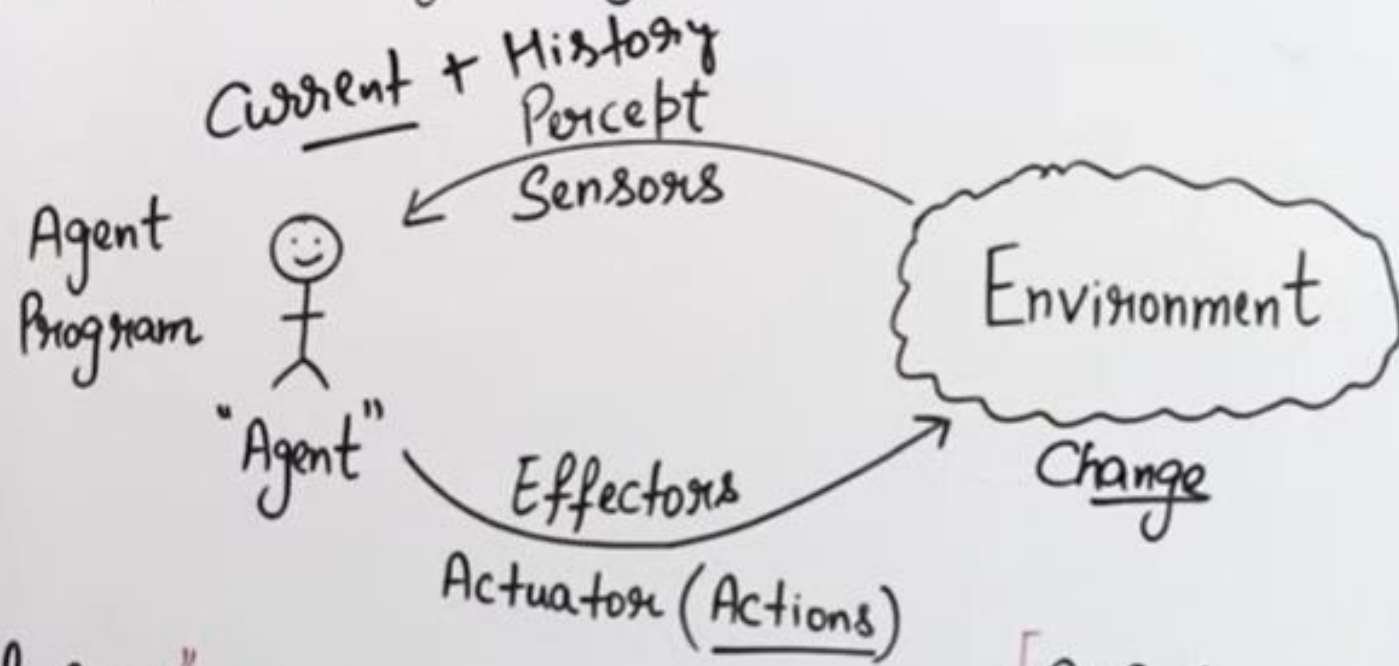
- 1) Search with information
- 2) Use knowledge to find steps to solution
- 3) Quick solution
- 4) Less Complexity (Time, Space)
- 5)  $A^*$  Heuristic DFS, Best first Search

Heuristic  $h(n)$





# Agents / Intelligent Agents



"Goals of Agent" → High Performance  
Optimized Result  
Rational Action Right

Agent → Percept → Decision → Actions

## "Types"

- 1) Simple Reflex Agents
- 2) Model Based Reflex
- 3) Goal Based Agents
- 4) Utility-Based Agents
- 5) Learning Agents

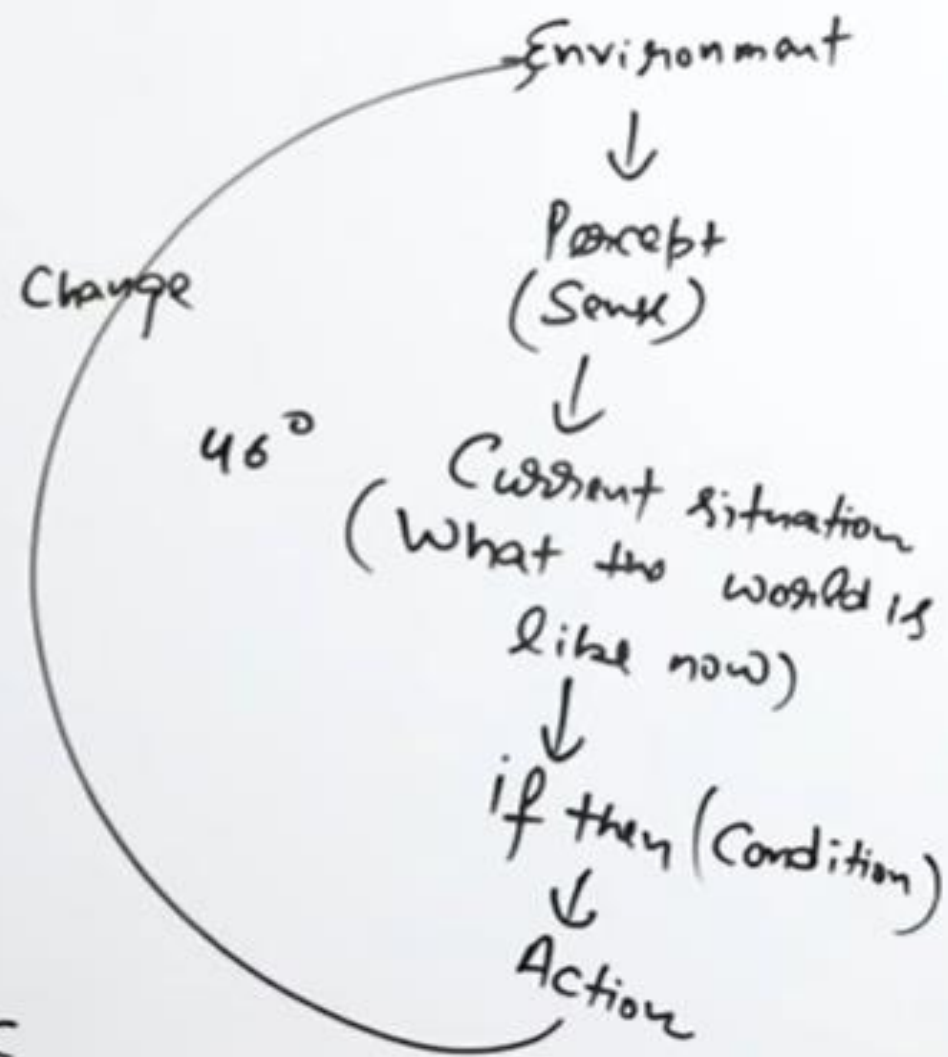
P: Performance  
E: Environment  
A: Actions  
S: Sensors

## "Simple Reflex Agents"

- ✓ Act only on the basis of current perception
- ✓ Ignore the rest of percept history
- Based on If-Then Rules
- Environment should be fully observable.  
Partially "



if temp  $> 45^{\circ}$   
then Switch on AC  
if Room is not empty



### 1. Simple Reflex agent:

The Simple reflex agents are the simplest agents. These agents take decisions on the basis of the current percepts and ignore the rest of the percept history.

These agents only succeed in the fully observable environment.

The Simple reflex agent does not consider any part of percepts history during their decision and action process. The Simple reflex agent works on Condition-action rule, which means it maps the current state to action.

Such as a Room Cleaner agent, it works only if there is dirt in the room.

Problems for the simple reflex agent design approach:

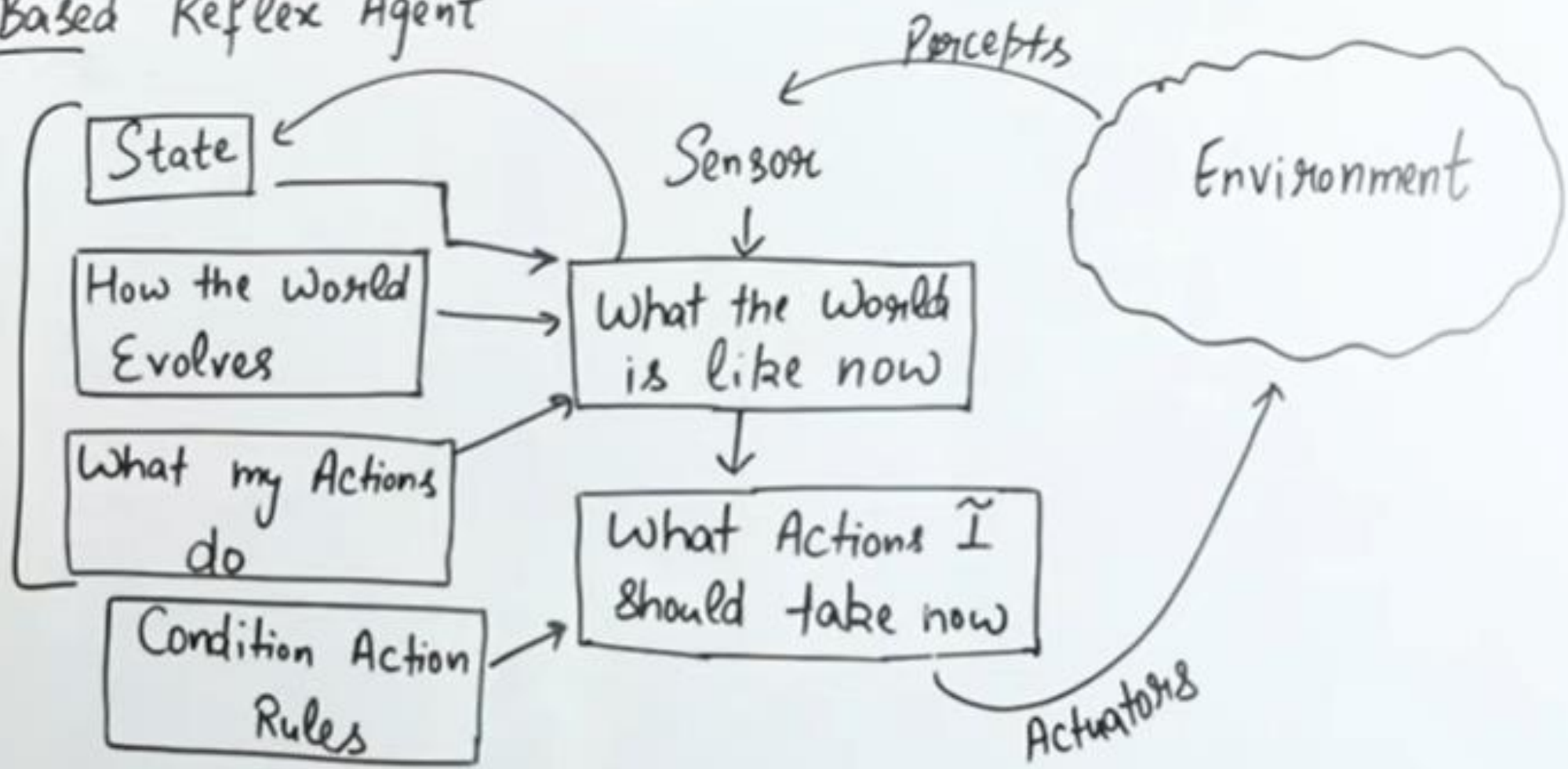
- They have very limited intelligence

- They do not have knowledge of non-perceptual parts of the current state

- Not adaptive to changes in the environment.



# "Model Based Reflex Agent"



Partially observable Environment  
Store Percept History (Internal Model)

## 2. Model-based reflex agent

The Model-based agent can work in a partially observable environment and track the situation.

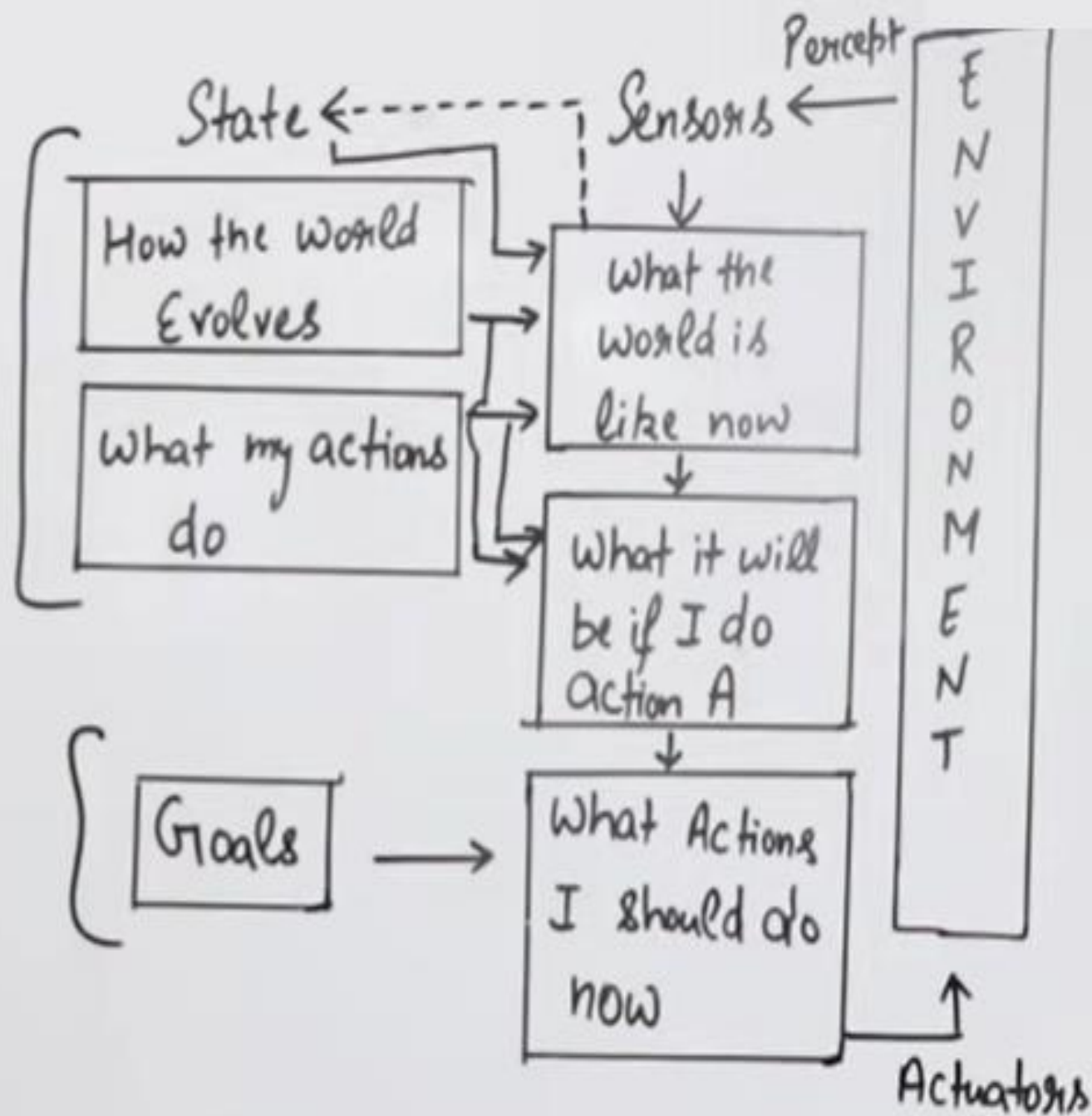
A model-based agent has two important factors:

**Model:** It is knowledge about "how things happen in the world," so it is called a Model-based agent.

**Internal State:** It is a representation of the current state based on percept history.

# Goal Based Agents

- Expansion of Model Based Reflex Agents
- Desirable Situation (Goal)
- Searching and Planning



### 3. Goal-based agents

The knowledge of the current state environment is not always sufficient to decide for an agent to what to do.

The agent needs to know its goal which describes desirable situations.

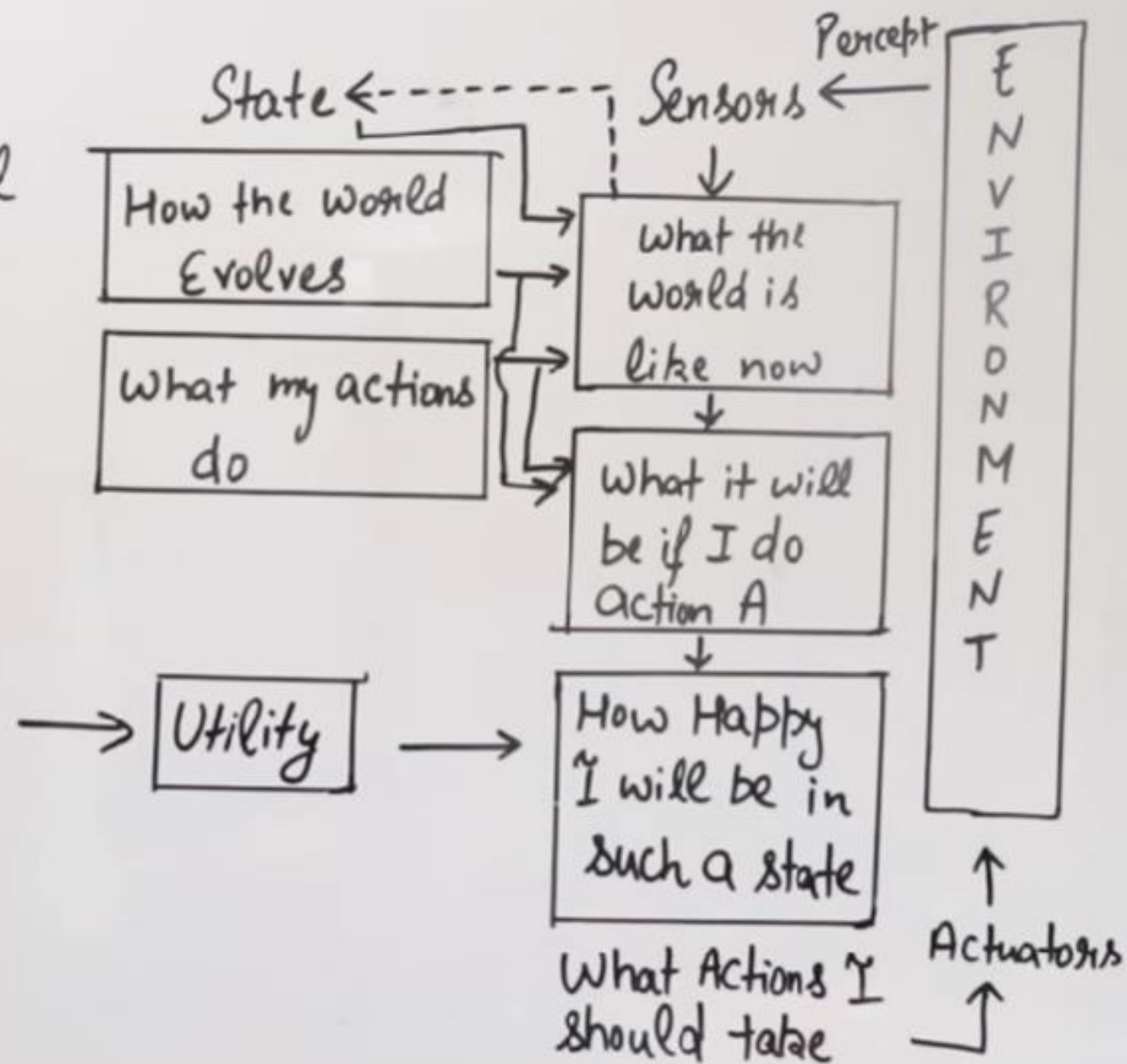
Goal-based agents expand the capabilities of the model-based agent by having the "goal" information.

They choose an action, so that they can achieve the goal.

These agents may have to consider a long sequence of possible actions before deciding whether the goal is achieved or not. Such considerations of different scenario are called searching and planning, which makes an agent proactive.

# Utility Based Agents

- Focus on Utility not goal
- Utility function
- Deals with Happy and Unhappy ~~etc.~~



### Utility-based agents

- These agents are similar to the goal-based agent but provide an extra component of utility measurement which makes them different by providing a measure of success at a given state.
- Utility-based agent act based not only goals but also the best way to achieve the goal.
- The Utility-based agent is useful when there are multiple possible alternatives, and an agent has to choose in order to perform the best action.
- The utility function maps each state to a real number to check how efficiently each action achieves the goals.



Artificial Intelligence:- AI is the study of how to make computer do things which people do better. [machine + human Intelligence]

↳ AI can cause a machine to work as human.

↳ AI → Artificial [Man-Made]  
          → Intelligence [Power of thinking]

GOALS OF AI: i) Replication of Human Intelligence.  
ii) Solving problems that require knowledge.  
iii) Building a machine that can do human Intelligence task. [CHESS, Proving theorem, automated car driving...]

Reasons of Boost in AI:

↳ i) S/W or device can be made to solve Real-time Problems.

ii) Creation of Virtual assistant [SIRI, CORTANA]

iii) Robots development. [Helps in dangerous env. cond<sup>n</sup>]

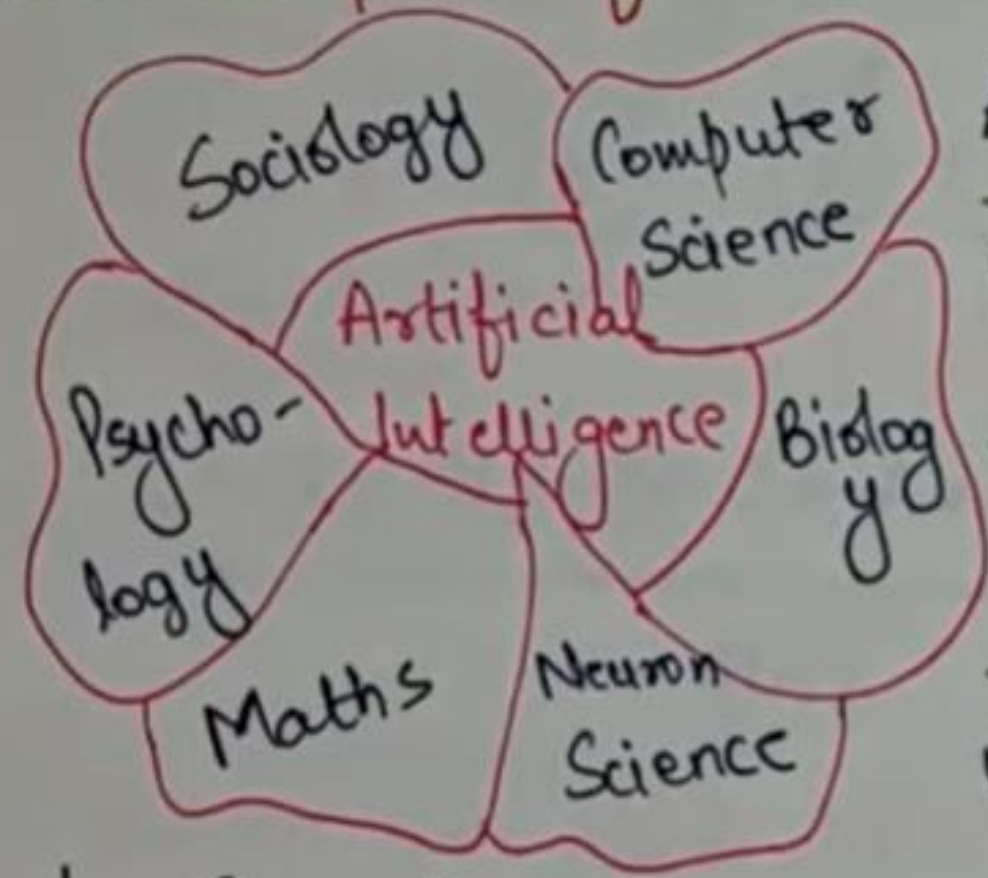
iv) New Job opportunities.

## Applications of AI:-

- ① AI in Gaming: Chess, Poker, tic-toe.  
↳ machine can think large no. of moves.
- ② AI in NLP: Natural lang. Processing  
↳ Machine can understand human lang.
- ③ AI in Healthcare: Fast diagnosis  
↳ Robotic Surgery.
- ④ AI in Finance: Adaptive Intelligence.  
↳ automatic chatbots, algorithm trading.
- ⑤ AI in Data Security: Helps in making data/app^n more secure.  
↳ AEG bot, AI2
- ⑥ Expert System: Integration of slw machine and special info^n to provide reasoning & advise.
- ⑦ Computer Vision: Understand the visual automatically by machine.
- ⑧ Speech Recognition: Extract - the meaning of sentence by human talk. [slang removal, noise rem.]
- ⑨ Robotics: Talk and behave like humans. ↳ Erica and Sophia.
- ⑩ AI in e-Commerce: Automatic recommendation of



## AI is Comprised of :-



- ↳ Reasoning
- ↳ Learning
- ↳ Problem solving
- ↳ Language Understanding.

## Advantages of AI

Accuracy  $\uparrow$  & Error  $\downarrow$

Fast Decision Making.

Reliability is more

usefulness in Risky Area.

Digital Assistant

## Disadvantages of AI

COST  $\uparrow$

Can't think beyond the limits.

No feeling & emotions

more dependency on machines  $\uparrow$ .

No original thinking

## Classification of AI:-

Narrow AI

WEAK AI: Able to perform dedicated task with Intelligence. [Not concerned with How]  
↳ Can't perform beyond its field or limitations.

↳ Example:-

- Flying machine
- Using logics
- Apple SIRI
- Playing chess

Evolutionary AI: It is the study and design of machines that simulate simple creatures and attempt to evolve.

↳ Example: Ants, Bees etc.

Strong AI: It is the study and design of machines that simulate human mind to perform intelligent tasks.

↳ i) Borrowing ideas from psychology and neuroscience

↳ ii) Forgetting things, Genetics, Language.

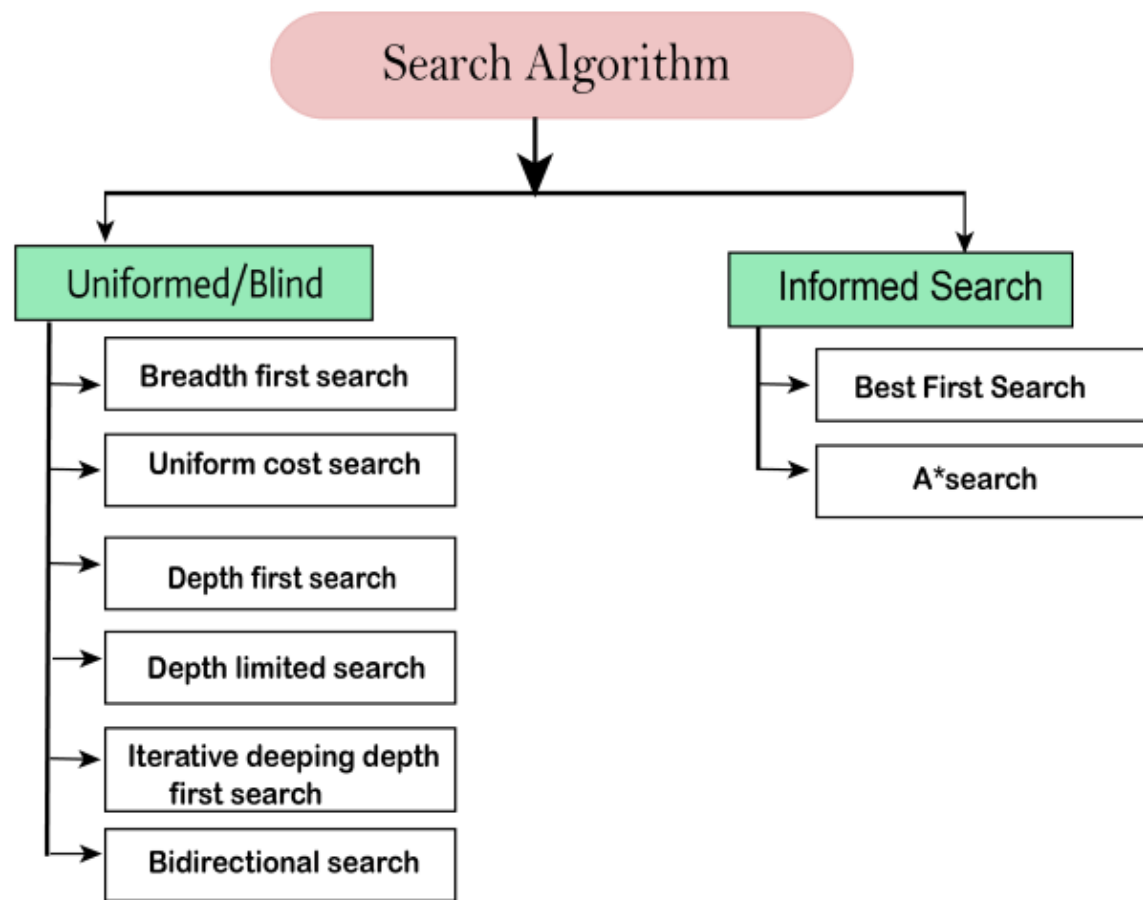
Super AI:- Hypothetical concept.  
machine > Human.  
[machine ↔ machine]





## Types of search algorithms

Based on the search problems we can classify the search algorithms into uninformed (Blind search) search and informed search (Heuristic search) algorithms.





## Difference between Informed and Uninformed Search in AI

### Informed

- **Use of Heuristics** – informed search algorithms use heuristics, or additional information, to guide the search process and prioritize which nodes to expand.
- **More efficient** – informed search algorithms are designed to be more efficient than uninformed search algorithms, such as breadth-first search or depth-first search, by avoiding the exploration of unlikely paths and focusing on more promising ones.
- **Goal-directed** – informed search algorithms are goal-directed, meaning that they are designed to find a solution to a specific problem.
- **Cost-based** – informed search algorithms often use cost-based estimates to evaluate nodes, such as the estimated cost to reach the goal or the cost of a particular path.
- **Prioritization** – informed search algorithms prioritize which nodes to expand based on the additional information available, often leading to more efficient problem-solving.
- **Optimality** – informed search algorithms may guarantee an optimal solution if the heuristics used are admissible (never overestimating the actual cost) and consistent (the estimated cost is a lower bound on the actual cost).

**Examples of informed search algorithms include A\* search, Best-First search, and Greedy search. Example: Greedy Search and Graph Search.**

## Uninformed Search in AI

Algorithms have no additional information on the goal node other than the one provided in the problem definition.

### uninformed search algorithms in AI:

- **Systematic exploration** – uninformed search algorithms explore the search space systematically, either by expanding all children of a node (e.g. BFS) or by exploring as deep as possible in a single path before backtracking (e.g. DFS).
- **No heuristics** – uninformed search algorithms do not use additional information, such as heuristics or cost estimates, to guide the search process.
- **Blind search** – uninformed search algorithms do not consider the cost of reaching the goal or the likelihood of finding a solution, leading to a blind search process.
- **Simple to implement** – uninformed search algorithms are often simple to implement and understand, making them a good starting point for more complex algorithms.
- **Inefficient in complex problems** – uninformed search algorithms can be inefficient in complex problems with large search spaces, leading to an exponential increase in the number of states explored.

Ques:- Differentiate b/w blind and heuristic Search.

Blind Search:- It is also known as unknown/uninformed Search.

↳ There is no info<sup>n</sup> about the Searching.

↳ No Knowledge of where the GOAL.

↳ Eg:- Depth first, Breadth first Search

↳ Efficiency is low

↳ Slower than Heuristic

Heuristic Search:- It is a method of solving problems more easily and fast. They have Knowledge of where goal or finish of the graph. (Informed Search)

Eg:- Hill climbing,  $A^*$ ,  $A_0^*$

↳ Highly efficient  $\begin{cases} \text{less time} \\ \text{less cost} \end{cases}$

↳ finds sol<sup>n</sup> quickly.



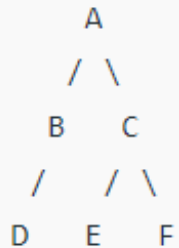
## Difference between BFS and DFS

### Breadth-First Search

BFS, Breadth-First Search, is a vertex-based technique for finding the shortest path in the graph. It uses a Queue data structure that follows first in first out. In BFS, one vertex is selected at a time when it is visited and marked then its adjacent are visited and stored in the queue. It is slower than DFS.

#### Example:

##### Input:



#### Output:

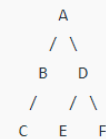
A, B, C, D, E, F

### Depth First Search

DFS, Depth First Search, is an edge-based technique. It uses the Stack data structure and performs two stages, first visited vertices are pushed into the stack, and second if there are no vertices then visited vertices are popped.

Example:

##### Input:



#### Output:

A, B, C, D, E, F

S. No.	Parameters	BFS	DFS
1.	Stands for	BFS stands for Breadth First Search.	DFS stands for Depth First Search.
2.	Data Structure	BFS(Breadth First Search) uses Queue data structure for finding the shortest path.	DFS(Depth First Search) uses Stack data structure.
3.	Definition	BFS is a traversal approach in which we first walk through all nodes on the same level before moving on to the next level.	DFS is also a traversal approach in which the traverse begins at the root node and proceeds through the nodes as far as possible until we reach the node with no unvisited nearby nodes.
4.	Technique	BFS can be used to find a single source shortest path in an unweighted graph because, in BFS, we reach a vertex with a minimum number of edges from a source vertex.	In DFS, we might traverse through more edges to reach a destination vertex from a source.
5.	Conceptual Difference	BFS builds the tree level by level.	DFS builds the tree sub-tree by sub-tree.
6.	Approach used	It works on the concept of FIFO (First In First Out).	It works on the concept of LIFO (Last In First Out).

**What is the other name of informed search strategy?**

- a) Simple search
- b) Heuristic search
- c) Online search
- d) None of the mentioned

**Uninformed search strategies are better than informed search strategies.**

- (A). True
- (B). False
- (C). Partially true
- (E). None of these

**Which of the following strategy is commonly known as a blind search?**

- (A). Simple reflex search
- (B). Informed search
- (C). Uninformed search
- (D). All of these
- (E). None of these

**Best-First search can be coded with the help of which of the following data structure.**

- (A). Queue
- (B). Stack
- (C). Linked list
- (D). All
- (E). None of these

**Which of the following is the search strategy the uses a not problem specific knowledge?**

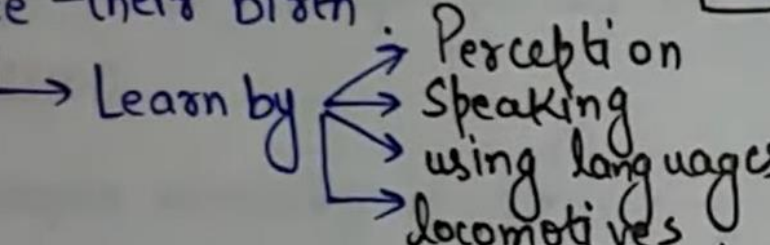
**Which of the following is the search strategy the uses a problem specific knowledge?**

- (A). Informed Search
- (B). A\* algorithm
- (C). Uninformed search
- (D). All of these
- (E). None of these

**which of the following uninformed search provides optimal solution?**

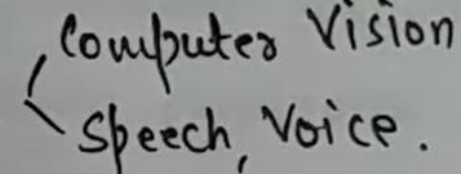
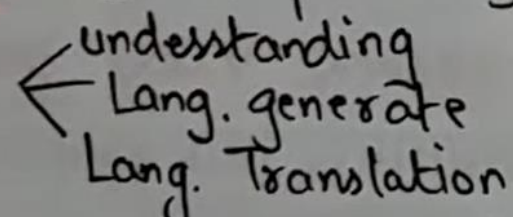
- a) Breadth First search
- b) Depth First search
- c) A star
- d) None of the mentioned

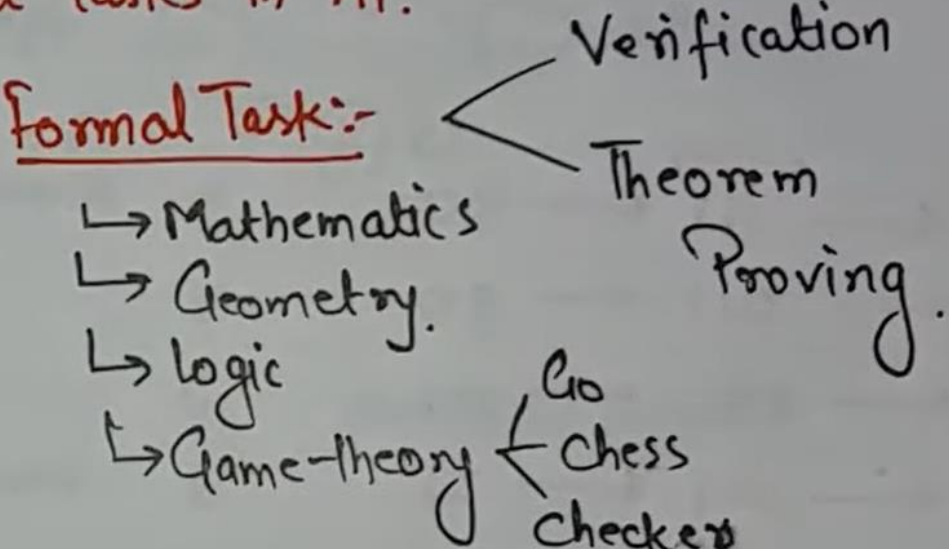
Ques:- Explain Formal, Mundane and Expert tasks in AI.

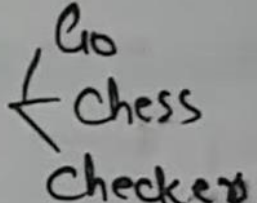
Humans Learn Mundane (Ordinary) tasks  
Since - their birth  
↳ Learn by  Perception  
Speaking  
using languages  
locomotives  
↳ Easiest to learn.

Formal and Expert task are learn later in the order.

Mundane:-

- ① Perception  Computer Vision  
Speech, Voice.
- ② NLP  understanding  
Lang. generate  
Lang. Translation.
- ③ Reasoning
- ④ Robotics (locomotive)

Formal Task:- 

- ↳ Mathematics
- ↳ Geometry.
- ↳ Logic
- ↳ Game-theory  Go  
Chess Checkers

Expert Task:- Engineering,  
↳ Manufacturing  
↳ Monitoring  
↳ Scientific, financial, Medical.

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Ques:- what do you mean by Chinese Room Test? BASIC CONFIGURATION:-

Explain how it can be performed?

↳ Also known as Chinese Room Argument.

↳ Proposed by Mr. John Searle in 1980.

↳ Argued that "Turing Test could not be used to determine whether or not machine is considered as intelligent".

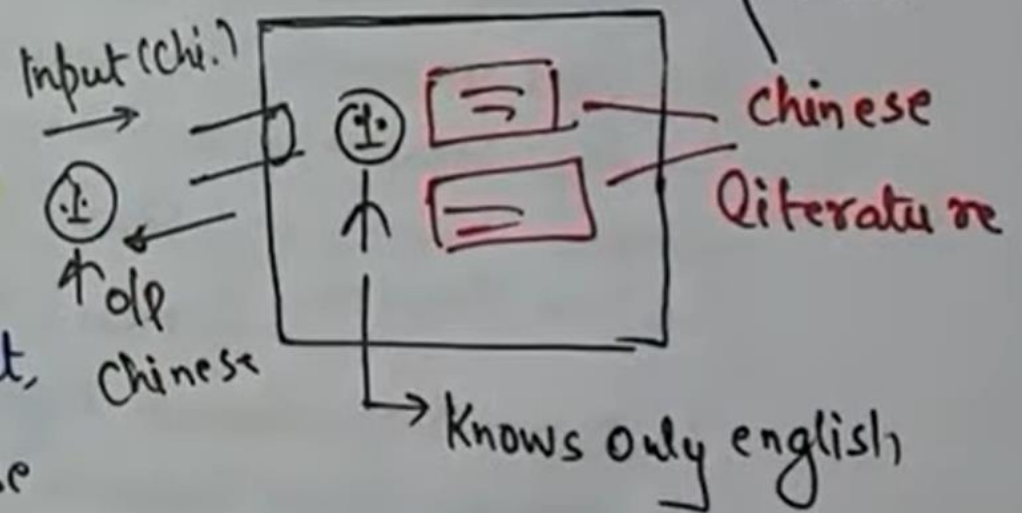
According to John Searle a machine could pass Turing Test simply by manipulating symbols, without any understanding of those symbols.

↳ A person/machine can be considered as intelligent, if and only if they have understanding of what they are doing.

↳ A person knowing English not Chinese sits in room with huge volume of Chinese literature.

↳ Chinese symbol  $\Phi$ , return  $\Psi$ . } Rules  
↳ " " "  $\Phi\Psi$ , return  $\Xi$ . }

↑ rules





Ques:- what do you mean by uncertainty?

why uncertainty arises?

Uncertainty is defined as - the  
Lack of exact info<sup>n</sup> or knowledge  
that helps us to find correct  
conclusion.

definition.

Uncertainty may be caused by problems  
with data such as:-

- ↳ ① Missing / unavailable data
- ② Unreliable / ambiguous data
- ③ Imprecise / Inconsistent ref<sup>n</sup> of data
- ④ Guess based

data.

Sources of Uncertainty:-

- ↳ ① Uncertain Inputs
  - ↳ Missing Data
  - ↳ Noisy data
- ② Uncertain Knowledge
  - ↳ multiple causes leads to multiple effects.
  - ↳ Incomplete knowledge of causality in domain.
- ③ Uncertain outputs
  - ↳ Abduction, induction are uncertain
  - ↳ Default reasoning
  - ↳ Incomplete deduction, inference.

**Medical Diagnosis system is example of which task domain in artificial intelligence.**

a) Mundane Task b) Expert task c) Formal Task d) Categorical Task

**Which of the following is not a task domain in artificial intelligence?**

a) Mundane Task

b) Expert task

c) Formal Task

d) Categorical Task

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- **Session 17-20:**

- o Current trends and future directions in A



**Who is known as the -Father of AI"?**

Fisher Ada  
Alan Turing  
**John McCarthy**  
Allen Newell

**Artificial Intelligence is about\_\_\_\_\_.**

- 1.Playing a game on Computer
- 2.Making a machine Intelligent**
- 3.Programming on Machine with your Own Intelligence
- 4.Putting your intelligence in Machine

**Select the most appropriate situation for that a blind search can be used.**

- 1.Real-life situation
- 2.Small Search Space**
- 3.Complex game
- 4.All of the above

**Explanation:** Blind Search is also known as uninformed search, and it does not contain any domain information such as closeness, location of the goal, etc. Hence the most appropriate situation that can be used for the blind search is Small-search Space.

**The application/applications of Artificial Intelligence is/are**

- 1.Expert Systems
- 2.Gaming
- 3.Vision Systems
- 4.All of the above**

**Among the given options, which search algorithm requires less memory?**

- 1.Optimal Search
- 2.Depth First Search
- 3.Breadth-First Search
- 4.Linear Search

**If a robot is able to change its own trajectory as per the external conditions, then the robot is considered as the\_\_**

- 1.Mobile
- 2.Non-Servo
- 3.Open Loop
- 4.Intelligent**

**Which of the given language is not commonly used for AI?**

- 1.LISP
- 2.PROLOG
- 3.Python
- 4.Pperl**

**A technique that was developed to determine whether a machine could or could not demonstrate the artificial intelligence known as the\_\_\_\_**

- 1.Boolean Algebra
- 2.Turing Test**
- 3.Logarithm
- 4.Algorithm

**The component of an Expert system is\_\_\_\_\_.**

- 1.Knowledge Base
- 2.Inference Engine
- 3.User Interface
- 4.All of the above**

**Which algorithm is used in the Game tree to make decisions of Win/Lose?**

- 1.Heuristic Search Algorithm
- 2.DFS/BFS algorithm
- 3.Greedy Search Algorithm
- 4.Min/Max algorithm**

**Which rule is applied for the Simple reflex agent?**

- 1.Simple-action rule
- 2.Simple &Condition-action rule
- 3.Condition-action rule**
- 4.None of the above

**Which agent deals with the happy and unhappy state?**

- 1.Utility-based agent**
- 2.Model-based agent
- 3.Goal-based Agent
- 4.Learning Agent

**Rational agent always does the right things.**

- 1.True**
- 2.False

**Explanation:** Rational agent has clear preference, goal, and acts in a way to maximize its performance. It is said that it always does the right things, which means it gives the best performance for each action.

**Which term describes the common-sense of the judgmental part of problem-solving?**

- 1.Values-based
- 2.Critical
- 3.Analytical
- 4.Heuristic**

**Which AI technique enables the computers to understand the associations and relationships between objects and events?**

- 1.Heuristic Processing**
- 2.Cognitive Science
- 3.Relative Symbolism
- 4.Pattern Matching

**Explanation:** Pattern matching is a way to check a given sequence of tokens in order to determine the presence of a given character or data in the given sequence. It allows computers to understand the relationship between objects and events.

**The search algorithm which is similar to the minimax search, but removes the branches that don't affect the final output is known as\_\_.**

- 1.Depth-first search
- 2.Breadth-first search
- 3.Alpha-beta pruning**
- 4.None of the above

**Explanation:** [Alpha-beta pruning](#) algorithm is the modified version of the Minimax algorithm and returns the same moves as the original algorithm, but it removes all those nodes/branches that do not affect the final decision.

**Among the given options, which is also known as inference rule?**

- 1.Reference
- 2.Reform
- 3.Resolution
- 4.None of the above

**Resolution is also known as inference rule as it shows the complete inference rule when applied to any search algorithm.**

**Automatic Reasoning tool is used in\_\_\_\_\_.**

- 1.Personal Computers
- 2.Microcomputers
- 3.LISP Machines**
- 4.All of the above

**Ways to achieve AI in real-life are\_\_\_\_\_.**

- 1.Machine Learning
- 2.Deep Learning
- 3.Both a & b**
- 4.None of the above

**The main tasks of an AI agent are\_\_\_\_\_.**

- 1.Input and Output
- 2.Moment and Humanly Actions
- 3.Perceiving, thinking, and acting on the environment
- 4.None of the above

**Explanation:** The AI agent is the rational agent that runs in the cycle of Perceive, think, and act.

**The best AI agent is one which\_\_\_\_\_**

- 1.Needs user inputs for solving any problem
- 2.Can solve a problem on its own without any human intervention**
- 3.Need a similar exemplary problem in its knowledge base
- 4.All of the above

**Explanation:** The best AI agent is one that can solve the problem on its own without any human intervention.

**blind search will be acceptable when this situation occurs:**

- a. **small search space**
- b. complex game
- c. real-life situation
- d. All of the above

**The other name for a robot's "arm" is its:**

- a. **Manipulator**
- b. End Effector
- c. Servomechanism
- d. Actuator

**The Automatic Reasoning Tool (ART) can be used on:**

- a. microcomputers
- b. LISP machines**
- c. personal computers
- d. All of the above

**One of the definitions of Artificial Intelligence focuses on various problem-solving methods used in processing:**

- a. touch
- b. algorithms
- c. smell
- d. symbols**

**The component of an Expert system is\_\_\_\_\_.**

- 1.Knowledge Base
- 2.Inference Engine
- 3.User Interface
- 4.All of the above

The available ways to solve a problem of state-space-search.

- 1.1
- 2.2**
- 3.3
- 4.4

**Explanation:** There are only two ways to solve the problems of state-space search.

**Which algorithm takes two sentences as input and returns a Unifier?**

- 1.Inference
- 2.Hill-Climbing
- 3.Unify algorithm
- 4.Depth-first search

**Explanation:** The unify algorithm takes two atomic sentences and return a unifier. It is used for the unification process.

**The PEAS in the task environment is about\_\_\_\_\_.**

- 1.Peer, Environment, Actuators, Sense
- 2.Performance, Environment, Actuators, Sensors
- 3.Perceiving, Environment, Actuators, Sensors
- 4.None of the above

**Web Crawler is an example of\_\_\_\_\_.**

- 1.Intelligent Agent
- 2.Problem-solving agent
- 3.Simple reflex agent
- 4.Model-based agent

**Explanation:** The web crawler is an example of Intelligent agents, which is responsible for collecting resources from the Web, such as HTML documents, images, text files, etc.





















