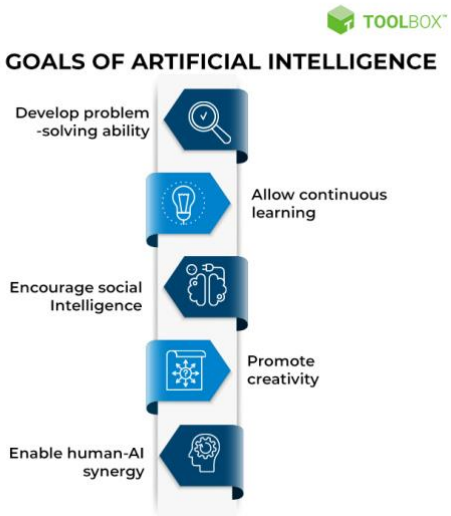
Sri Eshwar College of Engineering
An Autonomous Institution
Affiliated to Anna University, Chennai

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

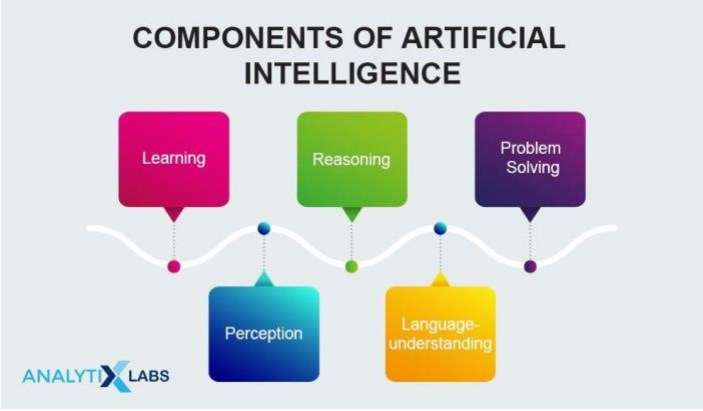
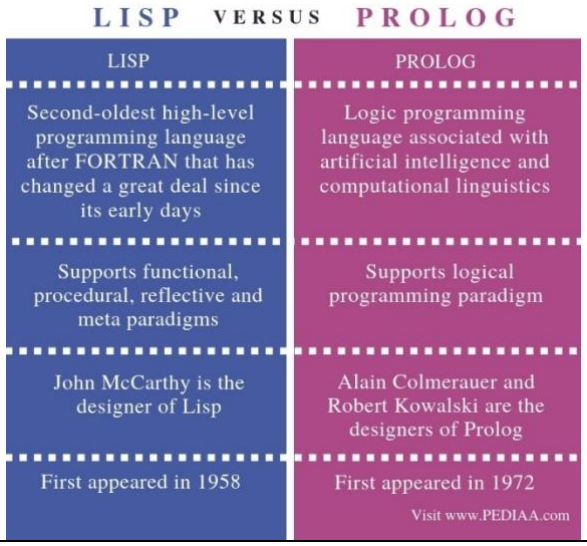
(Common to B. Tech-IT)

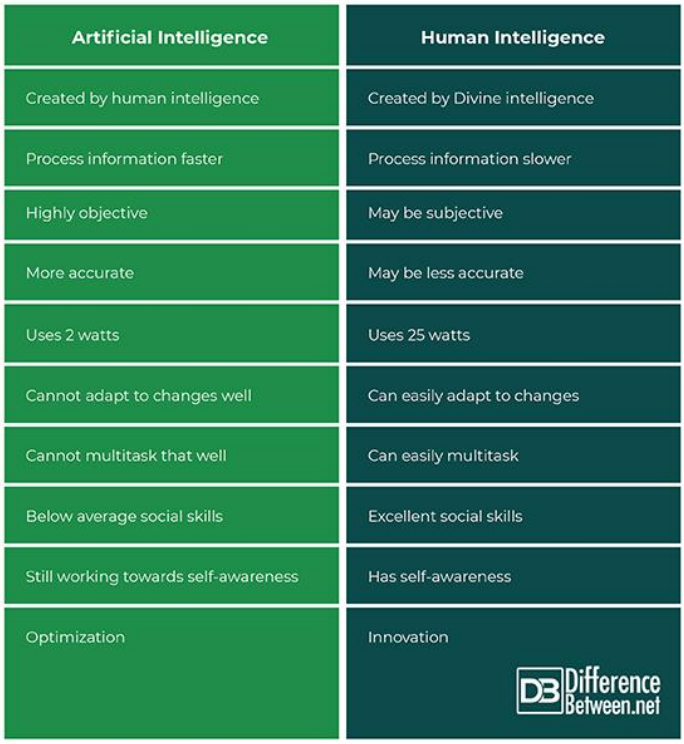
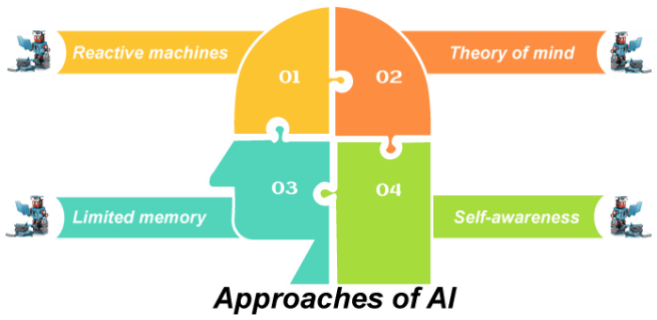
Course Code: U19CS302
Course: Artificial Intelligence
Semester: V
Academic Year:2022-2023

Question Bank

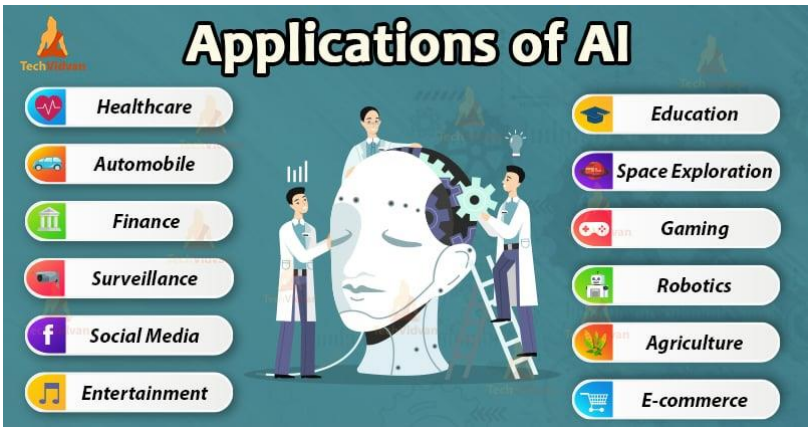
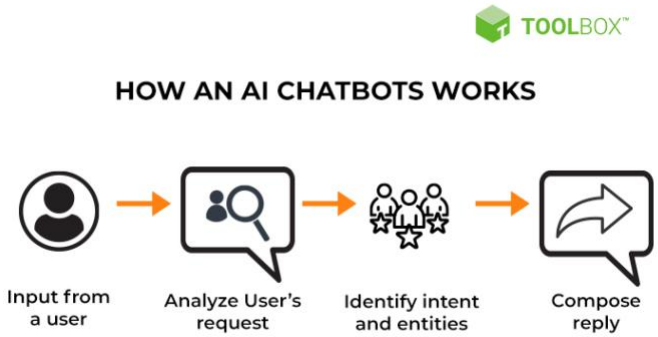
Module – I			
Part -A			
Q.No	**Questions**	**BT Level**	**Cognizance Level**
1.	Define Artificial Intelligence. ❖ Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. ❖ Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.	BTL 1	Remember
2.	What are the goals of AI? 	BTL 1	Remember

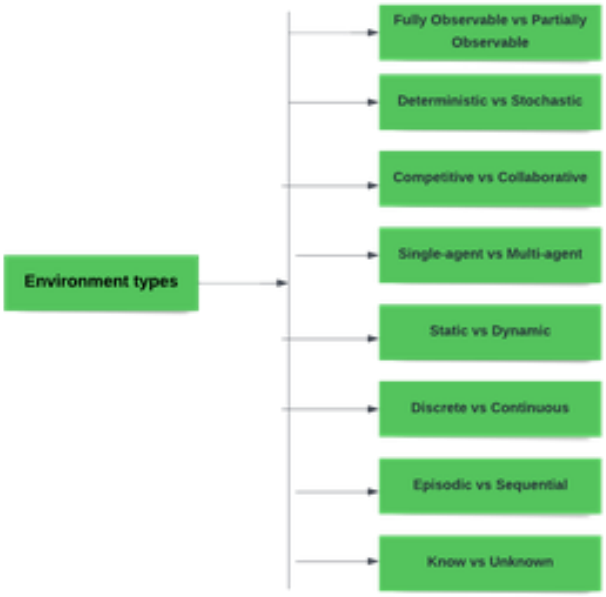
3.	Define Strong AI. ❖ Strong artificial intelligence (strong AI) is an artificial intelligence construct that has mental capabilities and functions that mimic the human brain. ❖ Strong AI aims to create intelligent machines that are indistinguishable from the human mind.	BTL 1	Remember
4.	Define an Agent. ❖ Artificial intelligence is defined as the study of rational agents. ❖ A rational agent could be anything that makes decisions, as a person, firm, machine, or software. ❖ It carries out an action with the best outcome after considering past and current percepts(agent's perceptual inputs at a given instance).	BTL 1	Remember
5.	List the various terminologies associated with Agent. ❖ Environment ❖ Sensors ❖ Actuators ❖ Agent	BTL 2	Understand
6.	Compare Fully Observable vs Partially Observable environment in AI. ❖ When an agent sensor is capable to sense or access the complete state of an agent at each point in time, it is said to be a fully observable environment else it is partially observable. ❖ Maintaining a fully observable environment is easy as there is no need to keep track of the history of the surrounding. ❖ An environment is called unobservable when the agent has no sensors in all environments. ❖ **Examples:** ✓ Chess – the board is fully observable, and so are the opponent's moves. ✓ Driving – the environment is partially observable because what's around the corner is not known.	BTL 2	Understand
7.	What is the purpose of planning in AI? ❖ Planning is a long-standing sub-area of Artificial Intelligence (AI). ❖ Planning is the task of finding a procedural course of	BTL 1	Remember

	action for a declaratively described system to reach its goals while optimizing overall performance measures.		
8.	Define Non-Classical Planning. ❖ In case of Classical Planning, the environment is fully observable, deterministic, static and discrete, ❖ Whereas in case of Non-classical Planning, the environment is partially observable (i.e. the entire state of the environment is not visible at a given instant) or non- deterministic.	BTL 1	Remember
9.	Give the various steps in Planning.	BTL 1	Remember
10.	How the actions are represented in a problem.	BTL 2	Understand
11.	Summarize the major components of AI 	BTL 2	Understand
12.	Distinguish between LISP and PROLOG 	BTL 2	Understand
13.	Differentiate natural intelligence from artificial intelligence	BTL 2	Understand

	Artificial Intelligence VS **Human Intelligence**  		
14.	List four approaches that are followed in AI  	BTL 2	Understand
15.	Define uncertainty. ❖ Till now, we have learned knowledge representation using first-order logic and propositional logic with certainty, which means we were sure about the predicates. ❖ With this knowledge representation, we might write A→B, which means if A is true then B is true, but consider a situation where we are not sure about whether A is true or not then we cannot express this statement, this situation is called uncertainty.	BTL 1	Remember

	❖ So to represent uncertain knowledge, where we are not sure about the predicates, we need uncertain reasoning or probabilistic reasoning.		

16.	How uncertainty is solved? ❖ default or non-monotonic logic ❖ probability ❖ fuzzy logic ❖ truth-value as evidential support ❖ Bayesian theory ❖ probability reasoning.	BTL 2	Understand
17.	Give some real-world applications of AI. 	BTL 1	Remember
18.	What is the intelligent agent in AI, and where are they used? ❖ AI assistants, like Alexa and Siri, are examples of intelligent agents as they use sensors to perceive a request made by the user and the automatically collect data from the internet without the user's help. ❖ They can be used to gather information about its perceived environment such as weather and time.	BTL 1	Remember
19.	What is a Chatbot? ❖ A chatbot is defined as a conversational application that aids in customer service, engagement, and support by replacing or augmenting human support agents with artificial intelligence (AI) and other automation technologies that can communicate with end-users via chat. 	BTL 1	Remember
20.	What are the different areas where AI has a great impact? ❖ Information Technology (IT)	BTL 1	Remember

	❖ Finance ❖ Marketing ❖ Healthcare ❖ Education		
	Part – B		
1.	Illustrate the six types of environments in AI with an example. Answer: An environment in artificial intelligence is the surrounding of the agent. The agent takes input from the environment through sensors and delivers the output to the environment through actuators. There are several types of environments: ▪ Fully Observable vs Partially Observable ▪ Deterministic vs Stochastic ▪ Competitive vs Collaborative ▪ Single-agent vs Multi-agent ▪ Static vs Dynamic ▪ Discrete vs Continuous ▪ Episodic vs Sequential ▪ Known vs Unknown  **1. Fully Observable vs Partially Observable** ❖ When an agent sensor is capable to sense or access the complete state of an agent at each	BTL 2	Understand

point in time, it is said to be a fully observable environment else it is partially observable.

- ❖ Maintaining a fully observable environment is easy as there is no need to keep track of the history of the surrounding.
- ❖ An environment is called unobservable when the agent has no sensors in all environments.
- ❖ Examples:
  - ✓ Chess – the board is fully observable, and so are the opponent's moves.
  - ✓ Driving – the environment is partially observable because what's around the corner is not known.

2. Deterministic vs Stochastic

- When a uniqueness in the agent's current state completely determines the next state of the agent, the environment is said to be deterministic.
- The stochastic environment is random in nature which is not unique and cannot be completely determined by the agent.
- Examples:
  - Chess – there would be only a few possible moves for a coin at the current state and these moves can be determined.
  - Self-Driving Cars- the actions of a self-driving car are not unique, it varies time to time.

3. Competitive vs Collaborative

- ❖ An agent is said to be in a competitive environment when it competes against another agent to optimize the output.
- ❖ The game of chess is competitive as the agents compete with each other to win the game which is the output.
- ❖ An agent is said to be in a collaborative environment when multiple agents cooperate to produce the desired output.
- ❖ When multiple self-driving cars are found on the roads, they cooperate with each other to avoid collisions and reach their destination which is the output desired.

4. Single-agent vs Multi-agent

- An environment consisting of only one agent is said to be a single-agent environment.
- A person left alone in a maze is an example of the single-agent system.
- An environment involving more than one agent is a multi-agent environment.
- The game of football is multi-agent as it involves 11 players in each team.

5. Dynamic vs Static

- An environment that keeps constantly changing itself when the agent is up with some action is said to be dynamic.
- A roller coaster ride is dynamic as it is set in motion and the environment keeps changing every instant.
- An idle environment with no change in its state is called a static environment.
- An empty house is static as there's no change in the surroundings when an agent enters.

6. Discrete vs Continuous

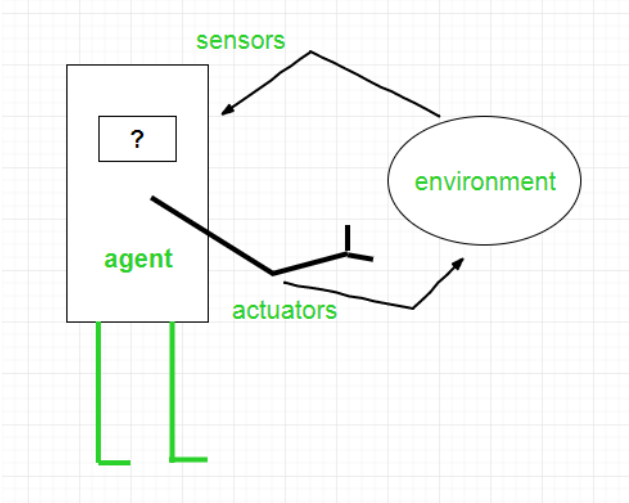
- If an environment consists of a finite number of actions that can be deliberated in the environment to obtain the output, it is said to be a discrete environment.
- The game of chess is discrete as it has only a finite number of moves. The number of moves might vary with every game, but still, it's finite.
- The environment in which the actions are performed cannot be numbered i.e. is not discrete, is said to be continuous.
- Self-driving cars are an example of continuous environments as their actions are driving, parking, etc. which cannot be numbered.

7.Episodic vs Sequential

- In an Episodic task environment, each of the agent's actions is divided into atomic incidents or episodes.

	There is no dependency between current and previous incidents. In each incident, an agent receives input from the environment and then performs the corresponding action. ❖ Example: Consider an example of Pick and Place robot, which is used to detect defective parts from the conveyor belts. Here, every time robot(agent) will make the decision on the current part i.e. there is no dependency between current and previous decisions. ❖ In a Sequential environment, the previous decisions can affect all future decisions. The next action of the agent depends on what action he has taken previously and what action he is supposed to take in the future. ❖ Example: ✓ Checkers- Where the previous move can affect all the following moves. **8. Known vs Unknown** ❖ In a known environment, the output for all probable actions is given. Obviously, in case of unknown environment, for an agent to make a decision, it has to gain knowledge about how the environment works.		
2.	Explain the various types of agents associated in AI in detail with suitable diagrams. Answer: ❖ Artificial intelligence is defined as the study of rational agents. A rational agent could be anything that makes decisions, as a person, firm, machine, or software. ❖ It carries out an action with the best outcome after considering past and current percepts(agent's perceptual inputs at a given instance). ❖ An AI system is composed of an **agent and its environment**. ❖ The agents act in their environment. The environment may contain other agents. ❖ An agent is anything that can be viewed as :	BTL 2	Understand

- ✓ perceiving its environment through **sensors** and
- ✓ acting upon that environment through **actuators**

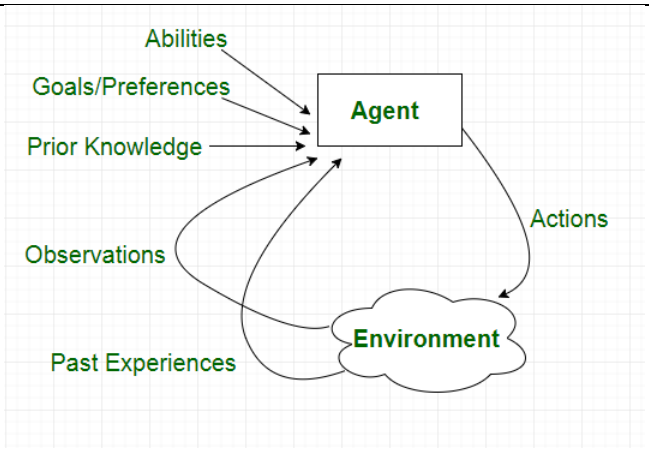


- ❖ To understand the structure of Intelligent Agents, we should be familiar with *Architecture* and *Agent* programs.
- ❖ **Architecture** is the machinery that the agent executes on.
- ❖ It is a device with sensors and actuators, for example, a robotic car, a camera, a PC.
- ❖ **Agent program** is an implementation of an agent function.

Agent = Architecture + Agent Program

Examples of Agent:

- ❖ A **software agent** has Keystrokes, file contents, received network packages which act as sensors and displays on the screen, files, sent network packets acting as actuators.
- ❖ A Human-agent has eyes, ears, and other organs which act as sensors, and hands, legs, mouth, and other body parts acting as actuators.
- ❖ A **Robotic agent** has Cameras and infrared range finders which act as sensors and various motors acting as actuators.



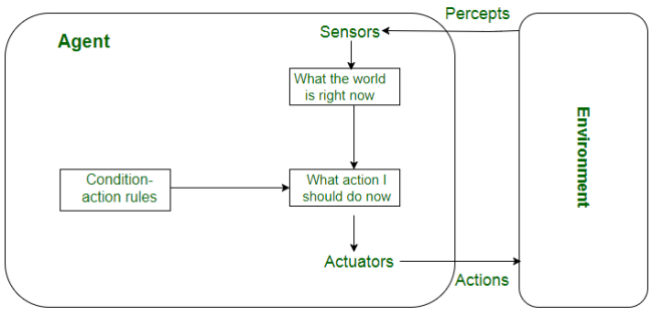
Types of Agents

- Agents can be grouped into five classes based on their degree of perceived intelligence and capability:
  - Simple Reflex Agents
  - Model-Based Reflex Agents
  - Goal-Based Agents
  - Utility-Based Agents
  - Leraning Agents

Simple reflex agents

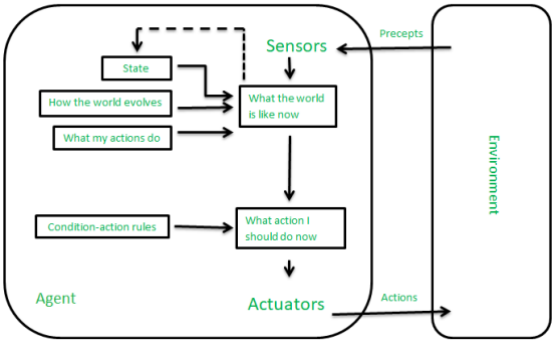
- Simple reflex agents ignore the rest of the percept history and act only on the basis of the **current percept**.
- Percept history is the history of all that an agent has perceived to date.
- The agent function is based on the **condition-action rule**.
- A condition-action rule is a rule that maps a state i.e, condition to an action.
- If the condition is true, then the action is taken, else not. This agent function only succeeds when the environment is fully observable.
- For simple reflex agents operating in partially observable environments, infinite loops are often unavoidable.
- It may be possible to escape from infinite loops if the agent can randomize its actions.

- Problems with Simple reflex agents are :
  - ✓ Very limited intelligence.
  - ✓ No knowledge of non-perceptual parts of the state.
  - ✓ Usually too big to generate and store.
  - ✓ If there occurs any change in the environment, then the collection of rules need to be updated.



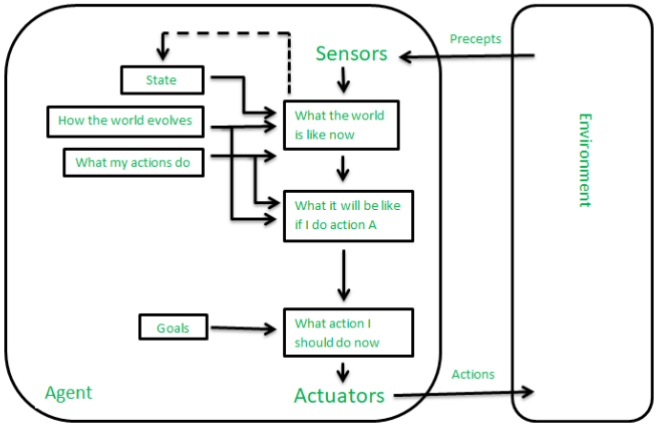
Model-based reflex agents

- It works by finding a rule whose condition matches the current situation.
- A model-based agent can handle **partially observable environments** by the use of a model about the world.
- The agent has to keep track of the **internal state** which is adjusted by each percept and that depends on the percept history.
- The current state is stored inside the agent which maintains some kind of structure describing the part of the world which cannot be seen.
- Updating the state requires information about:
  - ✓ how the world evolves independently from the agent, and
  - ✓ how the agent's actions affect the world.



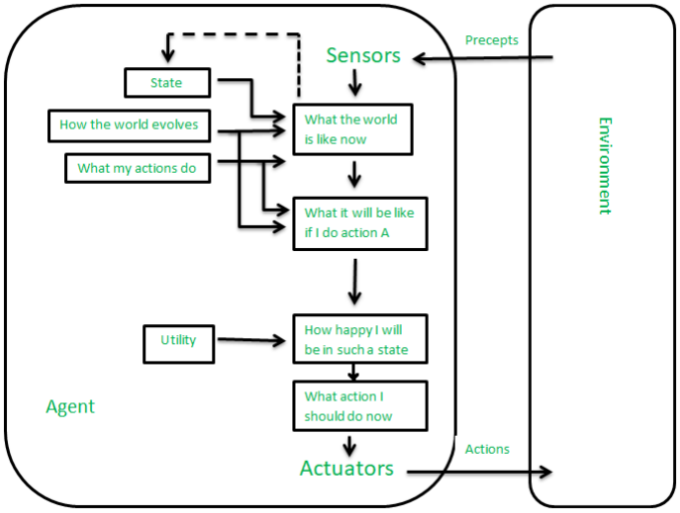
Goal-based agents

- These kinds of agents take decisions based on how far they are currently from their **goal** (description of desirable situations).
- Their every action is intended to reduce its distance from the goal.
- This allows the agent a way to choose among multiple possibilities, selecting the one which reaches a goal state.
- The knowledge that supports its decisions is represented explicitly and can be modified, which makes these agents more flexible.
- They usually require search and planning.
- The goal-based agent's behaviours can easily be changed.



Utility-based agents

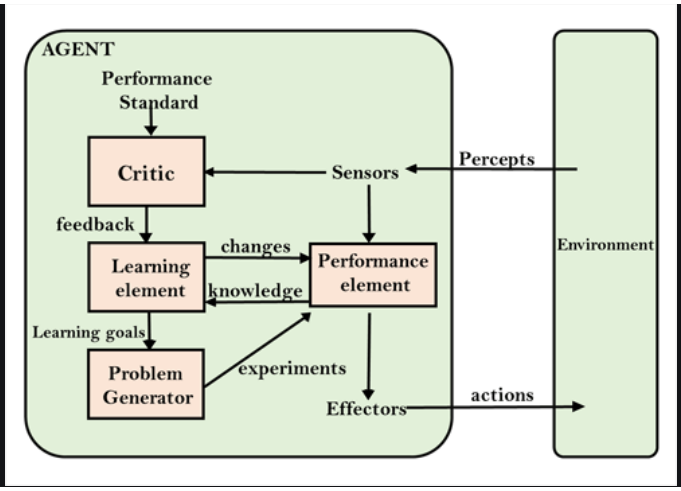
- The agents which are developed having their end uses as building blocks are called utility-based agents.
- When there are multiple possible alternatives, then to decide which one is best, utility-based agents are used.
- They choose actions based on a **preference (utility)** for each state. Sometimes achieving the desired goal is not enough.
- We may look for a quicker, safer, cheaper trip to reach a destination.
- Agent happiness should be taken into consideration. Utility describes how **"happy"** the agent is. Because of the uncertainty in the world, a utility agent chooses the action that maximizes the expected utility.
- A utility function maps a state onto a real number which describes the associated degree of happiness.



Learning Agent:

- A learning agent in AI is the type of agent that can learn from its past experiences or it has learning capabilities.
- It starts to act with basic knowledge and then is able to act and adapt automatically through learning.
- A learning agent has mainly four conceptual components, which are:

1. **Learning element:** It is responsible for making improvements by learning from the environment

	2. **Critic:** The learning element takes feedback from critics which describes how well the agent is doing with respect to a fixed performance standard. 3. **Performance element:** It is responsible for selecting external action 4. **Problem Generator:** This component is responsible for suggesting actions that will lead to new and informative experiences. 		
3.	Explain the two approaches used in planning with state spacesearch. Answer: ❖ The most straight forward approach is to use state-space search. ❖ Because the descriptions of actions in a planning problem specify both preconditions and effects, it is possible to search in either direction: forward from the initial state or backward from the goal. ❖ We can also use the explicit action and goal representations to derive effective heuristics automatically.	BTL 2	Understand

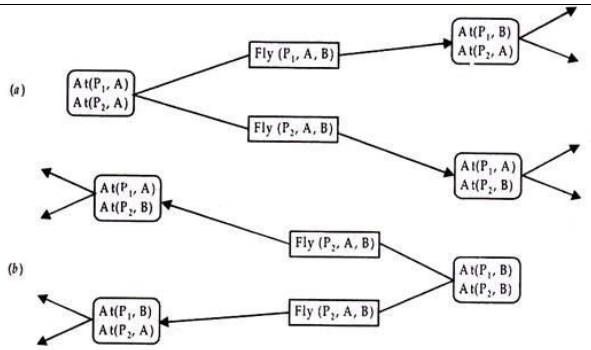


Fig. 8.5. *Two approaches to searching for a plan, (a) Forward (Progression) state-space search, starting in the initial state and using the problem's actions to search forward for the goal state, (b) Backward (regression) state-space search: a belief-state search starting at the goal state(s) and using the inverse of the actions to search backward for the initial state.*

1. Forward State-Space Search:

Planning with forward state-space search is similar to the problem-solving approach. It is sometimes called progression planning, because it moves in the forward direction.

We start with the problem's initial state, considering sequences of actions until we reach a goal state.

The formulation of planning problem as state-space search problems is as follows:
i. The initial state of the search is the initial state from the planning problem. In general each state will be set of positive ground literals; literals not appearing are false.

ii. The actions which are applicable to a state are all those whose preconditions are satisfied. The successor state resulting from an action is generated by adding the positive effect literals and deleting the negative effect literals.

iii. The goal test checks whether the state satisfies the goal of the planning problem.

iv. The step cost of each action is typically 1. Although it would be easy to allow different costs for different actions, this was seldom done by STRIPS planners.

Since function symbols are not present, the state space of a planning problem is finite and therefore, any graph search algorithm such as A * will be a complete planning algorithm.

From the early days of planning research it is known that forward state-space search is too inefficient to be practical. Mainly, this is because of a big branching factor since forward search does not address only relevant actions, (all applicable actions are considered). Consider for example, an air cargo problem with 10 airports, where each airport has 5 planes and 20 pieces of cargo.

The goal is to move all the cargo at airport A to airport B. There is a simple solution to the problem: load the 20 pieces of cargo into one of the planes at A, fly the plane to B, and unload the cargo. But finding the solution can be difficult because the average branching factor is huge: each of the 50 planes can fly to 9 other airports, and each of the 200 packages can be either unloaded (if it is loaded), or loaded into any plane at its airport (if it is unloaded).

On average, let's say there are about 1000 possible actions, so the search tree up to the depth of the obvious solution has about 1000 nodes. It is thus clear that a very accurate heuristic will be needed to make this kind of search efficient.

2. **Backward State-Space Search:**

Backward search can be difficult to implement when the goal states are described by a set of constraints which are not listed explicitly.

In particular, it is not always obvious how to generate a description of the possible predecessors of the set of goal states.

The STRIPS representation makes this quite easy because sets of states can be described by the literals which must be true in those states.

The main advantage of backward search is that it allows us to consider only relevant actions.

An action is relevant to a conjunctive goal if it achieves one of the conjuncts of the goal.

For example, the goal in our 10-airport air cargo problem is to have 20 pieces of cargo at airport B, or more precisely.

At (C1 B) ∧ At (C2 B)…….. At (C20, B)

Now consider the conjunct At (C1, B). Working backwards, we can seek those actions which have this as an effect,
There is only one:
Unload (C1p, B),
where plane p is unspecified.

We may note that there are many irrelevant actions which can also lead to a goal state. For example, we can fly an empty plane from Mumbai to Chennai; this action reaches a goal state from a predecessor state in which the plane is at Mumbai and all the goal conjuncts are satisfied. A backward search which allows irrelevant actions will still be complete, but it will be much less efficient. If a solution exists, it should be found by a backward search which allows only relevant action.

This restriction to relevant actions only means that backward search often has a much lower branching factor than forward search. For example, our air cargo problem has about 1000 actions leading forward from the initial state, but only 20 actions working backward from the goal. Hence backward search is more efficient than forward searching.

Searching backwards is also called regression planning. The principal question in regression planning is: what are the states from which applying a given action leads to the goal? Computing the description of these states is called regressing

the goal through the action. To see how does it work, once again consider the air cargo example. We have the goal

At (C1 B) ∧ At (C2 B) ∧…. ∧ At (C20, B)
The relevant action UNLOAD (C1 ‘ p, B) achieves the first conjunct. The action will work only if its preconditions are satisfied. Therefore, any predecessor state must include these preconditions: In (C1, p) ∧ At (p, B) as sub-goals. Moreover, the sub-goal At (C1, B) should not be true in the predecessor state which will no doubt be a goal but not relevant one (justify).

Thus, the predecessor description is:

In(C1, p) ∧ At(p, B) ∧ At(C2, B) ∧……∧ At (C20,B)
In addition to insisting that actions achieve some desired literal, we must insist that the actions do not undo any desired literals. An action which satisfies this restriction is called consistent. For example, the action load (C2, p) would not be consistent with the current goal, because it would negate the literal At (C2, B) (verify).
Given definitions of relevance and consistency, we can now describe the general process of constructing predecessors for backward search. Given a goal description G, let A be an action which is relevant and consistent.

The corresponding predecessor is constructed as follows:

I. Any positive effects of A which appear in G are deleted.

II. Each precondition literal of A is added, unless it already appears.

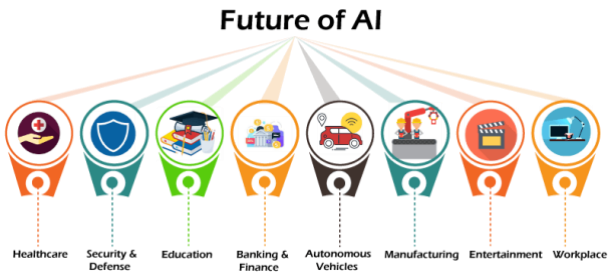
Any of the standard search algorithms can be used to carry out the search. Termination occurs when a predecessor description is generated which is satisfied by the initial state of the planning problem. In the first-order logic, satisfaction might require a substitution for variables in the predecessor

	description. For example, the predecessor description in the preceding paragraph is satisfied by the initial state. In (C1, P12) ∧ At (P12, B) ∧ At (C2, B) ∧ ……..∧ At (C20, B) with substitution (P/P12). The substitution must be applied to the action leading from the state to the goal, producing the solution [Unload (C1,P12, B)]		
4.	Summarize the steps in partial order planning in AI with an example. Answer: https://artint.info/2e/html/ArtInt2e.Ch6.S5.html	BTL 2	Understand
5.	Summarize the steps in Total order planning in AI with an example.	BTL 2	Understand
6.	Explain the role of artificial intelligence in the future. Answer: ❖ Undoubtedly, Artificial Intelligence (AI) is a revolutionary field of computer science, which is ready to become the main component of various emerging technologies like **big data, robotics, and IoT**. ❖ It will continue to act as a technological innovator in the coming years. In just a few years, AI has become a reality from fantasy. ❖ Machines that help humans with intelligence are not just in sci-fi movies but also in the real world. ❖ At this time, we live in a world of Artificial Intelligence that was just a story though for some years. ❖ We are using AI technology in our daily lives either unknowingly or knowingly, and somewhere it has become a part of our life. ❖ Ranging from Alexa/Siri to Chatbots, everyone is carrying AI in their daily routine. The development	BTL 2	Understand

and evolution of this technology are happening at a rapid pace.

- ❖ However, it was not as smooth and easy as it seemed to us. It has taken several years and lots of hard work & contributions of various people to take AI at this stage. Being so revolutionary technology, AI also deals with many controversies about its future and impact on Human beings.
- ❖ It may be dangerous, but also a great opportunity. AI will be deployed to enhance both defensive and offensive cyber operations.
- ❖ Additionally, new means of cyber-attack will be invented to take advantage of particular vulnerabilities of AI technology.
- ❖ This topic will discuss the future of AI and its impact on human life, i.e., whether it is a great technology or a threat to humans.

Future impact of AI in different sectors



Healthcare:

- ❖ AI will play a vital role in the healthcare sector for diagnosing diseases quickly and more accurately.
- ❖ New drug discovery will be faster and cost-effective with the help of AI.
- ❖ It will also enhance the patient engagement in their care and also make **ease appointment scheduling, bill paying**, with fewer errors.
- ❖ However, apart from these beneficial uses, one great challenge of AI in healthcare is to ensure its adoption in daily clinical practices.

Cyber security:

- ❖ Undoubtedly, cyber security is a priority of each organization to ensure data security.

- There are some predictions that cyber security with AI will have below changes:
    - With AI tools, security incidents will be monitored.
    - Identification of the origin of cyber-attacks with NLP.
    - Automation of rule-based tasks and processes with the help of RPA bots.

- However, being a great technology, it can also be used as a threat by attackers.
- They can use AI in a non-ethical way by using automated attacks that may be intangible to defend.

Transportation:

- The fully autonomous vehicle is not yet developed in the transportation sector, but researchers are reaching in this field.
- AI and machine learning are being applied in the cockpit to help reduce workload, handle pilot stress and fatigue, and improve on-time performance.
- There are several challenges to the adoption of AI in transportation, especially in areas of public transportation.
- There's a great risk of over-dependence on automatic and autonomous systems.

E-commerce:

- Artificial Intelligence will play a vital role in the e-commerce sector shortly.
- It will positively impact each aspect of the e-commerce sector, ranging from user experience to marketing and distribution of products.
- We can expect e-commerce with automated warehouse and inventory, shopper personalization, and the use of chatbots in future.

Employment:

	❖ Nowadays, employment has become easy for job seekers and simple for employers due to the use of Artificial Intelligence. ❖ AI has already been used in the job search market with strict rules and algorithms that automatically reject an employee's resume if it does not fulfil the requirement of the company. ❖ It is hoping that the employment process will be driven by most AI-enabled applications ranging from marking the written interviews to telephonic rounds in the future. ❖ For jobseekers, various AI applications are helping build awesome resumes and find the best job as per your skills, such as **Rezi, Jobseeker,** etc. ❖ Apart from above sectors, AI has great future in manufacturing, finance & banking, entertainment, etc.		
7.	Explain the partial tabulation using a simple agent function for avacuum cleaner problem. Answer:	BTL 2	Understand
8.	Explain the probabilistic reasoning with suitable examples. Answer: **Uncertainty:** ❖ Till now, we have learned knowledge representation using first-order logic and propositional logic with certainty, which means we were sure about the predicates. ❖ With this knowledge representation, we might write A→B, which means if A is true then B is true, but consider a situation where we are not sure about whether A is true or not then we cannot express this statement, this situation is called uncertainty.	BTL 2	Understand

- So to represent uncertain knowledge, where we are not sure about the predicates, we need uncertain reasoning or probabilistic reasoning.

Causes of uncertainty:

Following are some leading causes of uncertainty to occur in the real world.

1. Information occurred from unreliable sources.
2. Experimental Errors
3. Equipment fault
4. Temperature variation
5. Climate change.

Probabilistic reasoning:

- Probabilistic reasoning is a way of knowledge representation where we apply the concept of probability to indicate the uncertainty in knowledge.
- In probabilistic reasoning, we combine probability theory with logic to handle the uncertainty.
- We use probability in probabilistic reasoning because it provides a way to handle the uncertainty that is the result of someone's laziness and ignorance.
- In the real world, there are lots of scenarios, where the certainty of something is not confirmed, such as "It will rain today," "behavior of someone for some situations," "A match between two teams or two players."
- These are probable sentences for which we can assume that it will happen but not sure about it, so here we use probabilistic reasoning.

Need of probabilistic reasoning in AI:

- When there are unpredictable outcomes.
- When specifications or possibilities of predicates becomes too large to handle.
- When an unknown error occurs during an experiment.

In probabilistic reasoning, there are two ways to solve problems with uncertain knowledge:

- **Bayes' rule**
- **Bayesian Statistics**

As probabilistic reasoning uses probability and related terms, so before understanding probabilistic reasoning, let's understand some common terms:

Probability:

- ❖ Probability can be defined as a chance that an uncertain event will occur.
- ❖ It is the numerical measure of the likelihood that an event will occur.
- ❖ The value of probability always remains between 0 and 1 that represent ideal uncertainties.

  - ✓ $0 \leq P(A) \leq 1$, where P(A) is the probability of an event A.
  - ✓ P(A) = 0, indicates total uncertainty in an e vent A.
  - ✓ P(A) =1, indicates total certainty in an event A.

We can find the probability of an uncertain event by using the below formula.

$$\textbf{Probability of occurrence} = \frac{\text{Number of desired outcomes}}{\text{Total number of outcomes}}$$

- P(¬A) = probability of a not happening event.
- P(¬A) + P(A) = 1.

Event: Each possible outcome of a variable is called an event.

Sample space: The collection of all possible events is called sample space.

Random variables: Random variables are used to represent the events and objects in the real world.

Prior probability: The prior probability of an event is probability computed before observing new information.

Posterior Probability: The probability that is calculated after all evidence or information has taken into account. It is a combination of prior probability and new information.

Conditional probability:

- Conditional probability is a probability of occurring an event when another event has already happened.
- Let's suppose, we want to calculate the event A when event B has already occurred, "the probability of A under the conditions of B", it can be written as:

$$P(A|B) = \frac{P(A \wedge B)}{P(B)}$$

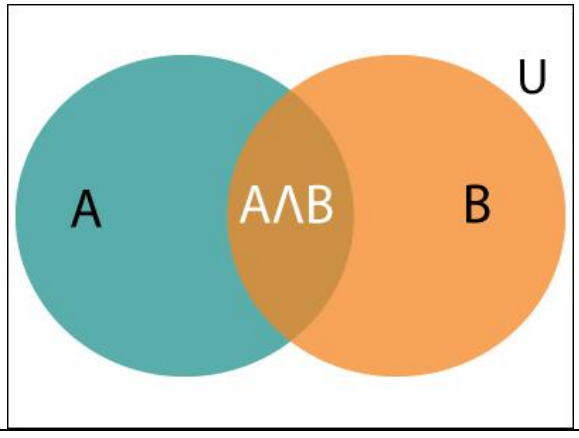
Where P($A \wedge B$)= Joint probability of a and B

P(B)= Marginal probability of B.

If the probability of A is given and we need to find the probability of B, then it will be given as:

$$P(B|A) = \frac{P(A \wedge B)}{P(A)}$$

It can be explained by using the below Venn diagram, where B is occurred event, so sample space will be reduced to set B, and now we can only calculate event A when event B is already occurred by dividing the probability of **P($A \wedge B$) by P(B)**.



Example:

In a class, there are 70% of the students who like English and 40% of the students who likes English and mathematics, and then what is the percent of students those who like English also like mathematics?

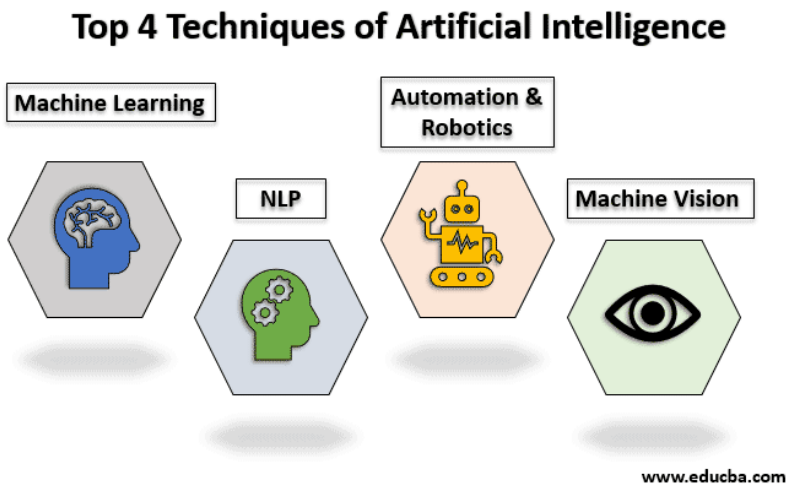
Solution:

Let, A is an event that a student likes Mathematics

B is an event that a student likes English.

$$P(A|B) = \frac{P(A \wedge B)}{P(B)} = \frac{0.4}{0.7} = 57\%$$

Hence, 57% are the students who like English also like Mathematics.

Module – II			
Part -A			
Q.No	**Questions**	**BT Level**	**Cognizance Level**
1.	Define a Problem in AI. ❖ Collection of information used by an agent to decide an action. ❖ First specialization – state space problem.	BTL 1	Remember
2.	How can a well-defined problem be represented? ❖ A well-defined problem can be described by: Initial state. Operator or successor function - for any state x returns s(x), the set of states reachable from x with one action. ❖ State space - all states reachable from initial by any sequence of actions.	BTL 2	Understand
3.	List three important AI techniques. 	BTL 1	Remember
4.	Define Searching in AI. ❖ Search in AI is the process of navigating from a starting state to a goal state by transitioning through intermediate states. ❖ Almost any AI problem can be defined in these terms.	BTL 1	Remember

	❖ State — A potential outcome of a problem. ❖ Transition — The act of moving between states. ❖ Starting State — Where to start searching from.		
5.	List the four types of AI. ❖ Reactive Machines ❖ Limited Memory ❖ Theory of Mind ❖ Self Aware	BTL 1	Remember
6.	What is Theory of Mind in AI? ❖ In psychology, "Theory of Mind" means that people have thoughts, feelings and emotions that affect their behavior. ❖ Future AI systems must learn to understand that everyone (both people and AI objects) have thoughts and feelings. Future AI systems must know how to adjust their behavior to be able to walk among us.	BTL 1	Remember

7.	What is State Space Search? ❖ State space search is a process used in the field of computer science, including artificial intelligence (AI), in which successive configurations or states of an instance are considered, with the intention of finding a goal state with the desired property.	BTL 1	Remember
8.	What are the steps in solving problems using State Space Search? ❖ First, select some way to represent states in the given problem in an unambiguous way. ❖ Next, formulate all actions or operators that can be performed in states, including their preconditions and effects. Actions or operates are called PRODUCTION RULES. ❖ Represent the initial state or states of the problem. ❖ Formulate precisely when a state satisfies the goal of our problem. ❖ Activate the production rules on the initial state and its descendants, until a goal state is reached.	BTL 1	Remember
9.	List the types of uninformed search algorithms in Searchingtechnique. The various types of uninformed search algorithms: ❖ Breadth-first Search ❖ Depth-first Search ❖ Depth-limited Search ❖ Iterative deepening depth-first search ❖ Uniform cost search ❖ Bidirectional Search	BTL 1	Remember
10.	Define Heuristic Search. ❖ A Heuristic is a technique to solve a problem faster than classic methods, or to find an approximate solution when classic methods cannot. ❖ Heuristic Search in AI are: ✓ Hill climbing ✓ Constraint Satisfaction Problem ✓ Simulated Annealing ✓ Best First Search (BFS)	BTL 1	Remember

11.	How the distance (h2(n)) will be calculated in the 8-Puzzle problem. ❖ The distance can be calculated by heuristic search - A* Algorithm. This algorithm is used in pathfinding and graph traversal. ❖ The key feature of the A* algorithm is that it keeps a track of each visited node which helps in ignoring the nodes that are already visited, saving a huge amount of time.	BTL 3	Application
12.	What is Generate and Test Search? ❖ Generate and Test Search is a heuristic search technique based on Depth First Search with Backtracking which guarantees to find a solution if done systematically and there exists a solution. ❖ In this technique, all the solutions are generated and tested for the best solution.	BTL 1	Remember
13.	What are the properties of a good generator in Generate and TestSearch? The good generators need to have the following properties: ❖ Complete: Good Generators need to be complete i.e. they should generate all the possible solutions and cover all the possible states. ❖ Non-Redundant: Good Generators should not yield a duplicate solution at any point of time ❖ Informed: Good Generators have the knowledge about the search space which they maintain in the form of an array of knowledge.	BTL 1	Remember
14.	List the parameters used to solve map coloring problem. ❖ The simplest approach to solve this problem would be to generate all possible combinations (or configurations) of colors. ❖ After generating a configuration, check if the adjacent vertices have the same color or not. ❖ If the conditions are met, add the combination to the result and break the loop.	BTL 1	Remember
15.	Give some real time examples of CSP.	BTL 1	Remember

	❖ Sudoku ❖ Crossword Puzzle are some of the examples for CSP.		
16.	Define Adversarial Search. ❖ Adversarial search is a search, where we examine the problem which arises when we try to plan ahead of the world and other agents are planning against us. ❖ Searches in which two or more players with conflicting goals are trying to explore the same search space for the solution, are called adversarial searches, often known as Games.	BTL 1	Remember
17.	Define Pruning and mention its threshold values. ❖ **Pruning:** Pruning in Artificial Intelligence is removing the nodes from the model to reach a better solution. Pruning is blocking the leaf nodes and removing the entire sub-tree to increase prediction accuracy by reduces the overfitting. ❖ **Determining pruning threshold:** Threshold is determined by finding the point after which, 90 % of the area under the curve is observed from left to right.	BTL 1	Remember
18.	How is a game playing problem defined in searching? ❖ A game can be defined as a type of search in AI which can be formalized of the following elements: Initial state: It specifies how the game is set up at the start. ❖ Player(s): It specifies which player has moved in the state space. Action(s): It returns the set of legal moves in state space.	BTL 2	Understand
19.	Mention the terminologies associated with problem formulation. ❖ State space ❖ Initial situation ❖ actions ❖ Goal test ❖ Path costs These are the terminologies associated with problem formulation.	BTL 2	Understand
20.	Define a Game Tree. ❖ A game tree is a type of recursive search function that examines all possible moves of a strategy	BTL 1	Remember

	game, and their results, in an attempt to ascertain the optimal move. ❖ **Examples:** Chess and Tic Tac Toe.		
	Part – B		
1.	Summarize the breath first and depth first search algorithm with an example. https://www.javatpoint.com/ai-uninformed-search-algorithms (DFS and BFS alone)	BTL 2	Understand
2.	Illustrate the depth limited search and iterative deepening depth firstsearch with an example. https://www.javatpoint.com/ai-uninformed-search-algorithms (Depth limited search and Iterative deepening depth first search alone)	BTL 2	Understand
3.	Explain the heuristic search with help of the 8-puzzle problem. http://science.slc.edu/~jmarshall/courses/2005/fall/cs151/lectures/heuristic-search/	BTL 2	Understand
4.	Compare the different types of Planning with sate space techniquesin AI. https://www.geeksforgeeks.org/what-is-the-role-of-planning-in-artificial-intelligence/amp/	BTL 2	Understand
5.	Discuss the generate and test search algorithm along with its properties and example. https://www.geeksforgeeks.org/generate-and-test-search/amp/	BTL 2	Understand
6.	Explain the Constraint Satisfaction Problem (CSP) in searching with the help of Map Coloring method.	BTL 2	Understand

	https://docs.ocean.dwavesys.com/en/stable/examples/map_coloring.html		
7.	Discuss the various steps in Minimax Algorithm in adversarial search strategy with an example. https://www.javatpoint.com/mini-max-algorithm-in-ai	BTL 2	Understand
8.	Summarize how the Alpha Beta Pruning algorithm can be applied to explore each node in a given tree. https://www.javatpoint.com/ai-alpha-beta-pruning	BTL 2	Understand

Module – III			
Part -A			
Q.No	**Questions**	**BT Level**	**Cognizance Level**
1.	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.	BTL 1	Remember
2.	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.	BTL 1	Remember
3.	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, …	BTL 1	Remember
4.	What are quantifiers? ❖ There is a 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 o Universal () o Existential ()	BTL 1	Remember
5.	What are the four properties for knowledge representation ? ❖ Representational adequacy ❖ Inferential adequacy ❖ Inferential efficiency ❖ Acquisitional efficiency	BTL 1	Remember

6.	What is the frame problem? ❖ The whole problem of representing the facts, the change as well as those that do not is known as frame problem	BTL 1	Remember
7.	What is structured knowledge representation? ❖ Structure knowledge representations were explored as a general representation for symbolic representation of declarative knowledge. ❖ One of the results was a theory for schema systems.	BTL 1	Remember
8.	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 .	BTL 1	Remember
9.	Difference between predicate and propositional logic. Propositional and Predicate Logic • Propositional Logic – The study of statements and their connectivity structure. • Predicate Logic – The study of individuals and their properties. • Study syntax and semantics for both. • Propositional logic more abstract and hence less detailed than predicate logic.	BTL 1	Remember
10.	Define AND –Elimination rule in propositional logic ❖ 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	BTL 1	Remember
11.	What is Forward chaining? Semantics of Bayesian Networks 1. Representing the full joint distribution 2. Conditional independence relations in Bayesian network	BTL 1	Remember
12.	What is Backward chaining?	BTL	Remember

	❖ Backward chaining is the logical process of inferring unknown truths from known conclusions by moving backward from a solution to determine the initial conditions and rules. ❖ Backward chaining is often applied in artificial intelligence (AI) and may be used along with its counterpart, forward chaining.	1	
13.	Give the Baye's rule equation? **W.K.T** P(A^B) = P(A/B) P(B) ----------1 P(A^B) = P(B/A) P(A) ----------2 **DIVIDING BY P(A);** WE GET P(B/A) = P(A/B) P(B) P(A)	BTL 2	Understand
14.	Write the semantics of the Bayesian network? Semantics of Bayesian Networks 1. Representing the full joint distribution 2. Conditional independence relations in Bayesian network	BTL 2	Understand
15.	Why does uncertainty arise? ❖ Agents almost never have access to the whole truth about their environment. ❖ Agents cannot find a categorical answer.	BTL 2	Understand
16.	Discover the importance of Knowledge Base (KB) in Logic agents. It can be represented as: $\frac{\forall x\, P(x)}{P(c)}$ **Example:1.** IF "Every person like ice-cream"=> ∀x P(x) so we can infer that "John likes ice-cream" => P(c)	BTL 2	Understand
17.	Indicate objects, properties, functions and relations for a givenexample. **Example** "EVIL KING JOHN BROTHER OF RICHARD RULED ENGLAND IN 1200" **Objects:** John, Richard, England, 1200 **Relation**: Ruled **Properties:** Evil, King	BTL 2	Understand

	Functions: BROTHER OF		
18.	What are the two we use to query and answer in the knowledgebase? ❖ ASK ❖ TELL	BTL 1	Remember
19.	What is Existential introduction? • **A**n existential introduction is also known as an existential generalization, which is a valid inference rule in first-order logic. • This rule states that if there is some element c in the universe of discourse which has a property P, then we can infer that there exists something in the universe which has the property P. • It can be represented as: $\frac{P(c)}{\exists x P(x)}$	BTL 1	Remember
20.	Write the rule of Generalized Modus Ponens Rule. ❖ Generalized Modus Ponens can be summarized as, " P implies Q and P is asserted to be true, therefore Q must be True." ❖ According to Modus Ponens, for atomic sentences **pi, pi', q**. Where there is a substitution θ such that SUBST **(θ, pi',) = SUBST (θ, pi)**. ❖ It can be represented as: $\frac{p1', p2', \ldots, pn', (p1 \wedge p2 \wedge \ldots \wedge pn \Rightarrow q)}{SUBST(\theta, q)}$	BTL 2	Understand
	Part – B		
1.	How will you represent facts in propositional logic with an example?	BTL 2	Understand

	https://www.javatpoint.com/propositional-logic-in-artificial-intelligence		

2.	Consider the following sentences:(Answers) * John likes all kinds of food $\forall x$: food(x) $\rightarrow$ likes(john, x) * Apples are food food(apple) * Chicken is food food(chicken) * Anything anyone eats and isn't killed by is food $\forall x:(\exists y$: eats(y, x) $\wedge \neg$ killedby(y, x)) $\rightarrow$ food(x) *Bill eats peanuts and is still alive A. eats(Bill, peanuts) B. alive(Bill) *Sue eats everything Bill eats $\forall x$:eats(Bill, x)$\rightarrow$ eats(Sue, x) Translate these sentences into formulas in predicate logic.	BTL 3	Application
3.	Write short notes on Forward and Backward Chaining and Explainwith examples. Answer: https://www.javatpoint.com/forward-chaining-and-backward-chaining-in-ai	BTL 2	Understand
4.	Discuss how the unification will be done between two differentatomic sentences in first order logic. Answer: https://www.javatpoint.com/ai-unification-in-first-order-logic#:~:text=Unification%20depends%20on%20the%20substitution,%CE%A81%2C%20%CE%A82).	BTL 3	Understand
5.	Illustrate the four Inference rules that can be applied in first orderlogic with an example.	BTL 2	Understand

	Answer: https://www.javatpoint.com/ai-inference-in-first-order-logic		
6.	Explain any seven rules in representing knowledge in first order logic. Answer: ➢ First-order logic is another way of knowledge representation in artificial intelligence. It is an extension to propositional logic. ➢ FOL is sufficiently expressive to represent the natural language statements in a concise way. ➢ First-order logic is also known as Predicate logic or First-order predicate logic. First-order logic is a powerful language that develops information about the objects in a more easy way and can also express the relationship between those objects. ➢ First-order logic (like natural language) does not only assume that the world contains facts like propositional logic but also assumes the following things in the world: o Objects: A, B, people, numbers, colors, wars, theories, squares, pits, wumpus, ... o Relations: It can be unary relation such as: red, round, is adjacent, or n-any relation such as: the sister of, brother of, has color, comes between o Function: Father of, best friend, third inning of, end of, ... ➢ As a natural language, first-order logic also has two main parts: o Syntax	BTL 2	Understand

- Semantics

RULES:

- Rules are often used in rule-based expert systems, and are either specified explicitly by a knowledge engineer or they are derived from data using a machine learning or data mining algorithm.
- Logic is the use of symbolic and mathematical techniques for deductive reasoning.

	Rule	First-order logic
R1	IF animal has hair THEN species is mammal	$\forall x \text{Has\_hair}(x) \Rightarrow \text{Mammal}(x)$
R2	IF animal gives milk THEN species is mammal	$\forall x \text{ Gives\_milk}(x) \Rightarrow \text{Mammal}(x)$
R3	IF animal eats meat THEN species type is carnivore	$\forall x \text{ Eats\_meat}(x) \Rightarrow \text{Carnivore}(x)$
R4	IF animal has pointed teeth AND animal has claws AND animal has forward eyes THEN species type is carnivore	$\forall x \text{Has\_pointed\_teeth}(x) \wedge \text{Has\_claws}(x) \wedge \text{Has\_forward\_eyes}(x) \Rightarrow \text{Carnivore}(x)$
R5	IF animal is mammal AND animal has hooves THEN mammal group is ungulate	$\forall x \text{ Mammal}(x) \wedge \text{Has\_hooves}(x) \Rightarrow \text{Ungulate}(x)$
R6	IF species is mammal AND animal chews cud THEN mammal group is ungulate	$\forall x \text{ Mammal}(x) \wedge \text{Chews\_cud}(x) \Rightarrow \text{Ungulate}(x)$
R7	IF species is mammal AND species type is carnivore AND animal has tawny colour AND animal has dark spots THEN animal is cheetah	$\forall x \text{ Mammal}(x) \wedge \text{Carnivore}(x) \wedge \text{Has\_tawny\_colour}(x) \wedge \text{Has\_dark\_spots}(x) \Rightarrow \text{Cheetah}(x)$
R8	IF species is mammal AND species type is carnivore AND animal has tawny colour AND animal has black stripes THEN animal is tiger	$\forall x \text{ Mammal}(x) \wedge \text{Carnivore}(x) \wedge \text{Has\_tawny\_colour}(x) \wedge \text{Has\_black\_stripes}(x) \Rightarrow \text{Tiger}(x)$
R9	IF species is ungulate AND animal has dark spots AND animal has long neck THEN animal is giraffe	$\forall x \text{Ungulate}(x) \wedge \text{Has\_dark\_spots}(x) \wedge \text{Has\_long\_neck}(x) \Rightarrow \text{Giraffe}(x)$
R10	IF species is ungulate AND animal has black stripes THEN animal is zebra	$\forall x \text{Ungulate}(x) \wedge \text{Has\_black\_stripes}(x) \Rightarrow \text{Zebra}(x)$

7.	Consider the following rules and convert them to first-order logic. i. IF animal eats meat THEN species type is carnivore ii. IF animal is mammal AND animal has hoovesTHEN mammal group is ungulate iii. IF species is mammal AND animal chews cudTHEN mammal group is ungulate iv. IF Species is mammal AND species type is carnivore AND animal has tawny color AND animal has dark spotsTHEN animal is cheetah v. IF Species is mammal AND species type is carnivore AND animal has tawny color AND animal has black stripes THEN animal is cheetah vi. IF Species is ungulate AND animal has dark spots AND animal has long neck THEN animal is giraffe.	BTL 3	Application

	vii. IF Species is ungulate AND animal has black stripes THEN animal is Zebra.		
8.	Consider the following first-order logic and convert them to a setof conditional rules. i. ∀x Has_Hair(x) ->Mammal(x) ii. ∀x Eats_Meat(x)->Carnivore(x) iii. ∀x Has_Pointed_teeth(x)^ Has_claws(x)^Has_forward _eyes(x)->carnivore(x) iv. ∀x mammal(x) ^ carnivore(x) ^Has _tawny_color(x) ^Has_dark_spots(x) -> Cheetah(x) v. ∀x mammal(x) ^ carnivore(x) ^Has _tawny_color(x) ^Has_black_stripes(x) -> tiger(x) vi. ∀x Ungulate(x) ^ Has_dark_spots(x) ^ Has_long_neck(x)-> Giraffe(x) vii. ∀x Ungulate(x) ^ Has_black stripes (x) ->Zebra (x)	BTL 3	Application

Module – IV			
Part -A			
Q.No	**Questions**	**BT Level**	**Cognizance Level**
1.	What are PEAS? ❖ Performance ❖ Environment ❖ Actuators ❖ Sensors	BTL 1	Remember
2.	What are the different types of agents? ❖ Human Agent ❖ Robotic Agent ❖ Software Agent	BTL 1	Remember

	❖ Generic Agent		
3.	List down the characteristics of intelligent agents. Internal characteristics are ❖ Learning/reasoning ❖ reactivity ❖ autonomy ❖ Goal ❖ communication ❖ cooperation ❖ mobility ❖ Character	BTL 1	Remember
4.	Define DART? ❖ The Dynamic Analysis and Replanning Tool, commonly abbreviated to DART, is an artificial intelligence program used by the U.S. military to optimize and schedule the transportation of supplies or personnel and solve other logistical problems. ❖ DART uses intelligent agents to aid decision support systems located at the U.S. Transportation and European Commands	BTL 1	Remember
5.	Why do we need agent communication? Multi agent systems allow distributed problem solving ❖ This requires the agents to coordinate their actions ❖ Agent communication facilitates this by allowing individual agents to interact ❖ Allows cooperation ❖ Allows information sharing	BTL 2	Understand
6.	What is direct routing? ❖ Message sent directly to other agent(s) with no interception or attenuation in strength	BTL 1	Remember
7.	List the use of blackboard. ❖ Detect conflicts ❖ Different agents that want to perform the same task Notice incompatible solutions ❖ Solutions using a shared resource at the same time	BTL 1	Remember

	Share results ❖ Agents can use partial/complete results obtained by other agents Share tasks ❖ Agents can request help in solving sub-tasks		
8.	Illustrate message passing.  • Information is passed from one agent to another. The nature of this information can be very varied. Speech acts provide one way to describe this variety.	BTL 2	Understand
9.	List the types of speech act. ❖ Inform other agents about some data ❖ query others about their current situation ❖ answer questions ❖ request others to act ❖ promise to do something ❖ offer deals ❖ acknowledge offers and requests	BTL 1	Remember

10.	List the term involved in the structure of an AI agent. ❖ **Architecture:** Architecture is machinery that an AI agent executes on. ❖ **Agent Function:** Agent function is used to map a percept to an action. ❖ **Agent program:** Agent program is an implementation of agent function.	BTL 1	Remember
11.	Define Multi Agent Systems. ❖ Multi-agent systems (MAS) are a core area of research of contemporary artificial intelligence. ❖ A multi-agent system consists of multiple decision-making agents which interact in a shared environment to achieve common or conflicting goals.	BTL 1	Remember
12.	List the Benefits of Multi-Agent Systems. ❖ Modularity ❖ Efficiency ❖ Flexibility ❖ Reliablity	BTL 1	Remember
13.	How do Collaborative Agents Communicate? ❖ A multi-agent system(MAS) may be seen as a collection of collaborative agents. ❖ They can communicate and cooperate with other agents, while keeping their autonomy ❖ They usually negotiate with their peers to reach mutually acceptable agreements during cooperative problem solving	BTL 2	Understand
14.	How Does the Dispatcher Agent Work? ❖ Tells the agents registered in a blackboard about the changes produced on it that can be interesting / relevant for them. ❖ **Example:** new problem announcement => tell the agents that can be potentially	BTL 2	Understand

	interested in solving it.		
15.	What is meant by Black Board Systems.	BTL 1	Remember
16.	List the Positive and Negative Aspects Black Board Systems **Positive Aspects:** ❖ Flexible mechanism that allows communication/cooperation ❖ Independent of cooperation strategy ❖ It does not place any restriction on the agents internal architecture **Negative Aspects:** ❖ Centralized Structure ❖ System bottleneck ❖ Everyone has to write info on the blackboard ❖ Everyone has to read from the blackboard Single point of failure	BTL 1	Remember
17.	List the Parameters in FIPA ACL message. ▪ :sender - who sends the message ▪ :receiver - who is the recipient of the message ▪ :content - content of the message ▪ :reply-with - identifier of the message ▪ :reply-by - deadline for replying the message ▪ :in-reply-to - identifier of the message being replied ▪ :language – language in which the content is written ▪ :ontology - ontology used to represent the domain concepts ▪ :protocol - communication protocol to be followed ▪ :conversation-id - identifier of conversation	BTL 1	Remember
18.	List the Various Communication Protocols. ❖ FIPA-Query Protocol ❖ FIPA-Request Protocol ❖ FIPA-Contractnet Protocol	BTL 1	Remember
19.	State the Purpose of Communication Protocols. ❖ There are many situations in which agents engaged in	BTL 1	Remember

	a dialogue with a certain purpose exchange the same sequence of messages ❖ When an agent makes a question to another ❖ When an agent requests a service from another ❖ When an agent looks for help from other agents ❖ To ease the management of this typical message interchanges we can use predefined protocols		
20.	Mention the need of Communication Standards. ❖ Allow different groups to write cooperating agents ❖ Help abstract out communication, by defining high-level general languages and protocols	BTL 1	Remember
	Part -B		
1.	Outline the four basic kinds of Agent Programs. https://www.javatpoint.com/types-of-ai-agents	BTL 2	Understand
2.	Elaborate on Black Board Systems in MAS. https://ieeexplore.ieee.org/document/1425173	BTL 2	Understand
3.	Discuss about the Communication Standards and componentsof FIPA ACL http://www.fipa.org/specs/fipa00061/SC00061G.html	BTL 2	Understand
4.	Summarize the various quality attributes associated with evaluating the multi agent systems. https://www.intechopen.com/chapters/62674	BTL 2	Understand
5.	Elaborate the Properties of Task Environments in softwareagents. https://www.javatpoint.com/agent-environment-	BTL 2	Understand

	in-ai		
6.	Brief about the Speech Acts in Multi Agent Systems. https://www.mdpi.com/1999-4893/12/4/79/htm	BTL 2	Understand
7.	Illustrate the Argumentation Framework based on the different types of extensions. https://www.engati.com/glossary/argumentation-framework	BTL 2	Understand
8.	Explain the Computation reputation model in software agents.	BTL 2	Understand

Module – V			
Part -A			
Q.No	**Questions**	**BT Level**	**Cognizance Level**
1.	Define Learning An agent is learning if it improves its performance on future tasks after making observations about the world.	BTL 1	Remember
2.	State the idea behind Current Best Hypothesis Search The idea behind current-best-hypothesis search is to maintain a single hypothesis, and to adjust it as new examples arrive in order to maintain consistency.	BTL 1	Remember
3.	Define Generalization The extension of the hypothesis must be increased to include new examples. This is called generalization.	BTL 1	Remember
4.	What is a Boundary Set? • An ordering on the hypothesis space, namely, generalization/specialization. This is a partial ordering, which means that each boundary will not be a point but rather a set of hypotheses called a boundary set.	BTL 1	Remember
5.	What is the drawback of Current best Hypothesis Approach? Backtracking arises because the current-best-hypothesis approach has to choose a particular hypothesis as its best guess even though it does not have enough data yet to be sure of the choice.	BTL 2	Understand
6.	State the Important Property of Least Commitment Search. One important property of this approach is that it is incremental: one never has to go back and re examine the old examples.	BTL 2	Understand
7.	Define Memoization The technique of Memoization has long been used in computer science to speed up programs by saving the results of computation. The basic idea of memo functions is to accumulate a database of input– output pairs; when the function is called, it first checks the database to see whether it can avoid solving the problem from scratch.	BTL 1	Remember

8.	How Basic EBL Process Works? 1. Given an example, construct a proof that the goal predicate applies to the example using the available background knowledge 2. In parallel, construct a generalized proof tree for the variabilised goal using the same inference steps as in the original proof. 3. Construct a new rule whose left-hand side consists of the leaves of the proof tree and whose righthand side is the variabilized goal (after applying the necessary bindings from the generalized proof). 4. Drop any conditions from the left-hand side that are true regardless of the values of the variables in the goal.	BTL 2	Understand
9.	What is Explanation based Learning? Explanation-based learning is a method for extracting general rules from individual observations.	BTL 1	Remember
10.	State Specialization. The extension of the hypothesis must be decreased to exclude the example. This is called specialization.	BTL 2	Understand
11.	List the three factors involved in the Analysis of Efficiency Gains from EBL: 1. Adding large numbers of rules can slow down the reasoning process 2. To compensate for the slowdown in reasoning, the derived rules must offer significant increases in speed for the cases that they do cover. 3. Derived rules should be as general as possible, so that they apply to the largest possible set of cases.	BTL 2	Understand
12.	What is NLP and give some examples of it. •Natural Language Processing (NLP) makes it possible for computers to understand the human language. NLP analyses the grammatical structure of sentences and the individual meaning of words, then uses algorithms to extract meaning and deliver outputs. •Examples of NLP in action are virtual assistants, like Google Assist, Siri, and Alexa. NLP understands written and spoken text like *"Hey Siri, where is the nearest gas*	BTL 2	Understand

	station?" and transforms it into numbers, making it easy for machines to understand.		
13.	Define Syntactic Analysis Syntactic analysis – or parsing – analyzes text using basic grammar rules to identify sentence structure, how words are organized, and how words relate to each other.	BTL 2	Understand
14.	What is Tokenization? •**Tokenization** consists of breaking up a text into smaller parts called *tokens* (which can be sentences or words) to make text easier to handle.	BTL 2	Understand
15.	How Meaning can be inferred using PoS tagging? •**Part of speech tagging (PoS tagging)** labels tokens as *verb, adverb, adjective, noun*, etc. This helps infer the meaning of a word (for example, the word "book" means different things if used as a verb or a noun).	BTL 2	Understand
16.	Differentiate Between Lemmatization &Stemming and Stop Word Removal. • **Lemmatization & stemming** consist of reducing inflected words to their base form to make them easier to analyze. • **Stop-word removal** removes frequently occuring words that don't add any semantic value, such as *I, they, have, like, yours*, etc.	BTL 1	Remember
17.	Define Semantic Analysis •Semantic analysis focuses on capturing the meaning of text. First, it studies the meaning of each individual word (lexical semantics). Then, it looks at the combination of words and what they mean in context.	BTL 1	Remember
18.	Differentiate between Word Sense Disambiguation and Relationship Extraction •**Word sense disambiguation** tries to identify in which sense a word is being used in a given context. •**Relationship extraction** attempts to understand how entities (places, persons, organizations, etc) relate to each other in a text.	BTL 1	Remember

19.	Mention some use cases of NLP in business. ● Sentiment Analysis ● Language Translation ● Text Extraction ● Chatbots	BTL 2	Understand
20.	Show the ways how AI has Transformed the finance industry. 5 ways how AI has transformed the finance industry are – •Risk Assessment •Fraud Detection And Management •Financial Advisory Services •Trading •Process Automation	BTL 1	Remember
	Part – B		
1.	Explain the various steps of the basic EBL process in Learning. https://www.brainkart.com/article/Explanation-based-Learning_8916/ https://users.cs.cf.ac.uk/Dave/AI2/node148.html	BTL 2	Understand
2.	Elaborate about Natural language Processing in Finance and justifyhow it is related to Artificial Intelligence. https://www.avenga.com/magazine/nlp-finance-applications/ https://www.analyticssteps.com/blogs/6-applications-nlp-finance	BTL 2	Understand
3.	Explain how you can improve Agriculture and Farming with Artificial Intelligence. https://www.analyticsvidhya.com/blog/2020/11/artificial-intelligence-in-agriculture-using-modern-day-ai-to-solve-traditional-farming-problems/	BTL 2	Understand

	https://www.javatpoint.com/artificial-intelligence-in-agriculture		
4.	Elaborate the algorithm to find the minimal consistent determination in learning.	BTL 2	Understand
5.	Write Short notes about Chatbots in Artificial intelligence. https://www.investopedia.com/terms/c/chatbot.asp#:~:text=Chatbots%2C%20also%20called%20chatterbots%2C%20is,to%20nothing%20to%20engage%20with. (or) https://www.techtarget.com/searchcustomerexperience/definition/chatbot	BTL 2	Understand
6.	Explain the ways how AI has transformed the finance industry with an example. https://www.advancinganalytics.co.uk/blog/2021/8/26/mo482xc608yon5wplj0iobz7cjmtgk	BTL 2	Understand
7.	Argue- Artificial intelligence (AI)is the most exciting field in Robotics. https://aibusiness.com/verticals/robotics-and-artificial-intelligence-the-role-of-ai-in-robots	BTL 2	Understand
8.	Explain how implementation of expert systems and personalized learning are achieved with the help of AI. https://www.javatpoint.com/expert-systems-in-artificial-intelligence https://elearningindustry.com/benefits-of-artifcial-intelligence-in-personalized-learning	BTL 2	Understand