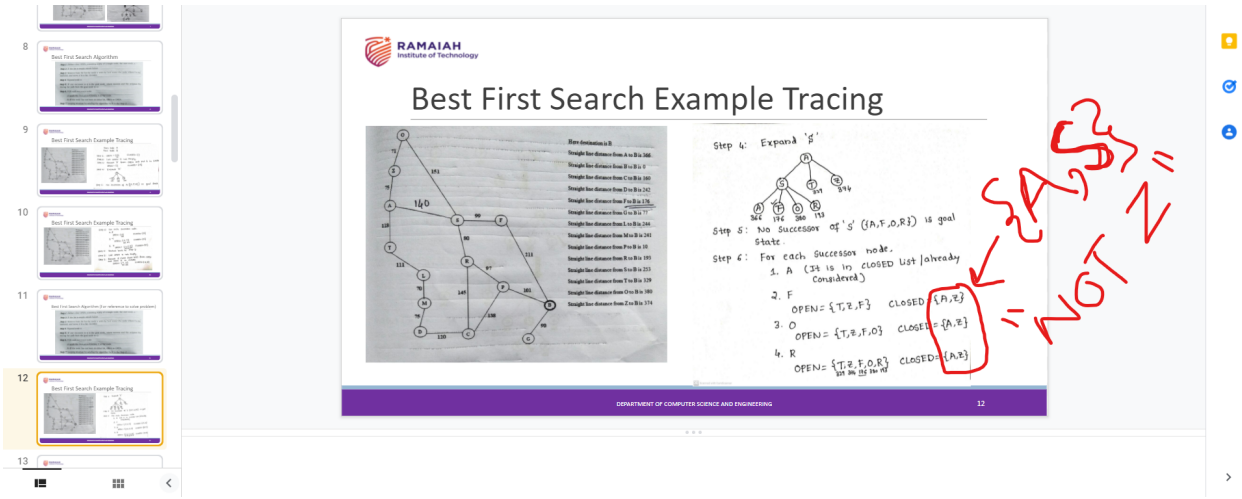


AI questions

Define Artificial Intelligence. Summarize any five common benefits of Artificial Intelligence technology. List out any five real-time applications of AI.

Artificial intelligence (AI) is the study of ideas that enable computers to be intelligent. The goals of the field of artificial intelligence are to make computers more useful and to understand the principles that make intelligence possible.

Advantages of Artificial Intelligence

1. Reduction in Human Error

One of the biggest advantages of Artificial Intelligence is that it can significantly reduce errors and increase accuracy and precision. The decisions taken by AI in every step is decided by information previously gathered and a certain set of algorithms. When programmed properly, these errors can be reduced to null.

2. Zero Risks

Another big advantage of AI is that humans can overcome many risks by letting AI robots do them for us. Whether it be defusing a bomb, going to space, exploring the

deepest parts of oceans, machines with metal bodies are resistant in nature and can survive unfriendly atmospheres. Moreover, they can provide accurate work with greater responsibility and not wear out easily.

3. 24x7 Availability

There are many studies that show humans are productive only about 3 to 4 hours in a day. Humans also need breaks and time offs to balance their work life and personal life. But AI can work endlessly without breaks. They think much faster than humans and perform multiple tasks at a time with accurate results. They can even handle tedious repetitive jobs easily with the help of AI algorithms.

4. Digital Assistance

Almost all the big organizations these days use digital assistants to interact with their customers which significantly minimizes the need for human resources. You can chat with a chatbot and ask them exactly what you need. Some chatbots have become so intelligent these days that you wouldn't be able to determine whether you are chatting with a chatbot or a human being.

5. New Inventions

AI has helped in coming up with new inventions in almost every domain to solve complex problems. A recent invention has helped doctors to predict early stages of breast cancer in women using advanced AI-based technologies.

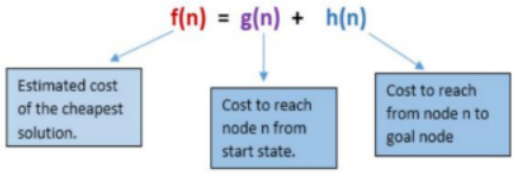
Applications of Artificial Intelligence

•Optical Character Recognition (OCR): Scanning typewritten/handwritten documents, finger prints, etc.
• Voice Recognition: Transcribing spoken words into ASCII text.
• Medical Diagnosis: Assisting doctors with their diagnosis by analyzing the reported symptoms and/or medical imaging data such as MRIs or X-rays.
• Oil Industry: To assist in predict PVT properties, Permeability Prediction, and Measure the reservoir Characterization,…etc.
• Target Recognition: Military application which uses video and/or infrared image data to determine if an enemy target is present.

•Targeted Marketing: Finding the set of demographics which have the highest response rate for a particular marketing campaign.
• Intelligent Searching: An internet search engine that provides the most relevant content and banner advertisements based on the users' past behavior.
• Fraud Detection: Detect fraudulent credit card transactions and automatically decline the charge.

Explain A* search algorithm with an example.

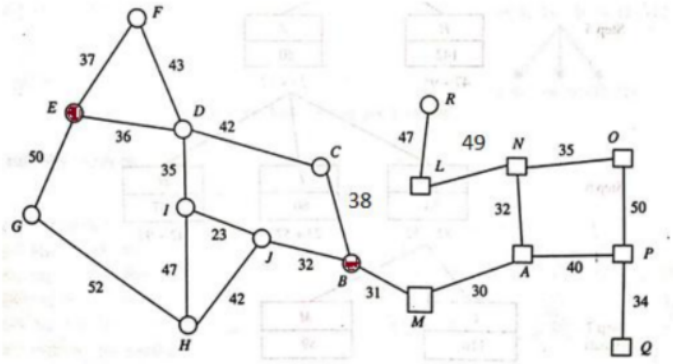
- A* search is the most commonly known form of best-first search.
- It uses heuristic function h(n), and cost to reach the node n from the start state g(n).
- A* search algorithm finds the shortest path through the search space using the heuristic function.
- In A* search algorithm, we use search heuristic as well as the cost to reach the node.

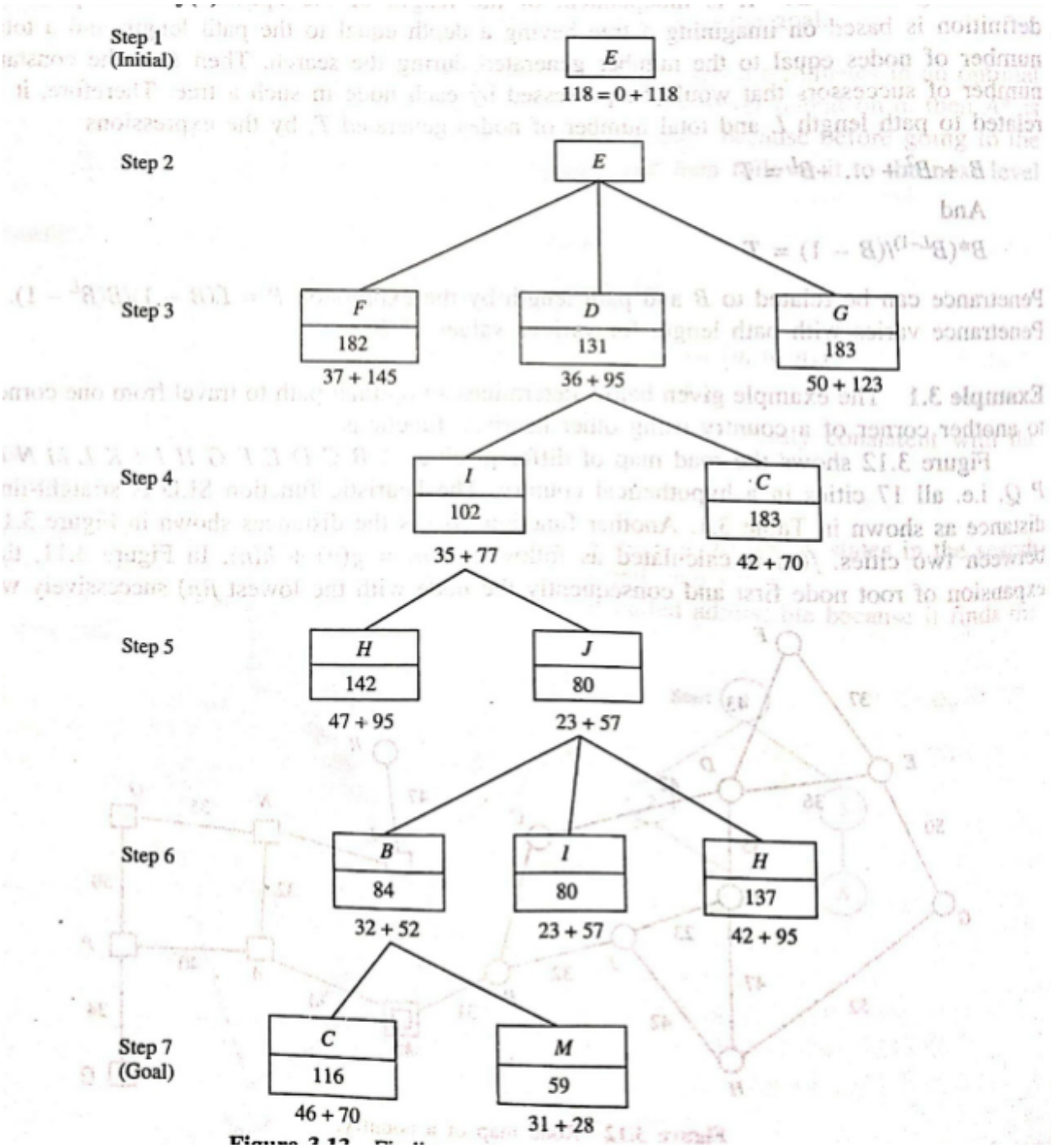


Examples: A*

Heuristic Table

A 24	F 145	K 108	P 65
B 28	G 123	L 51	Q 11
C 70	H 95	N 58	
D 95	I 77	O 10	
E 118	J 57	M 0	

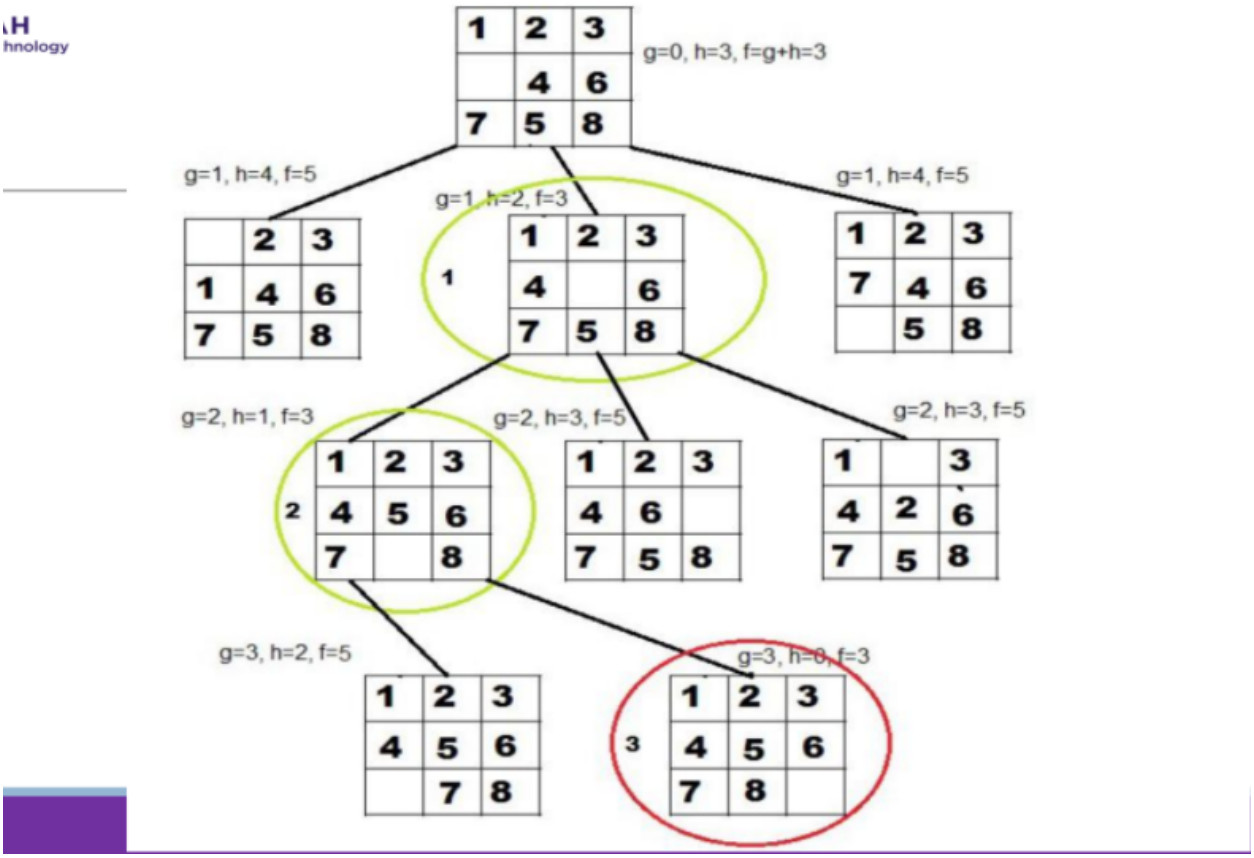




Define Heuristic search technique. Apply the heuristics technique to solve the 8 puzzle problem and explain the same. Also comment on the performance of the heuristic techniques.

Heuristic search algorithms expands nodes based on their heuristic value h(n).

- It maintains two lists, OPEN and CLOSED list.
- In the CLOSED list, it places those nodes which have already expanded
- In the OPEN list, it places nodes which have yet not been expanded.
- On each iteration, each node n with the lowest heuristic value is expanded and generates all its successors and n is placed to the closed list.
- The algorithm continues unit a goal state is found.
- Best First Search Algorithm(Greedy search)
- A* Search Algorithm



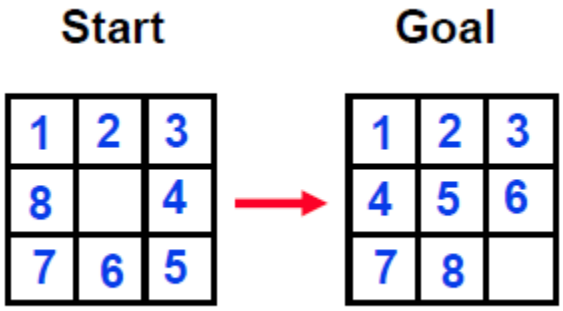
Define AI. Discuss the foundations and applications of AI

Artificial intelligence (AI) is the study of ideas that enable computers to be intelligent. The goals of the field of artificial intelligence are to make computers more useful and to understand the principles that make intelligence possible.

Foundations of AI

• Philosophy	Logic, methods of reasoning, mind as physical system foundations of learning, language, rationality
• Mathematics	Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
• Economics	utility, decision theory
• Neuroscience	physical substrate for mental activity
• Psychology	phenomena of perception and motor control, experimental techniques
• Computer engineering	building fast computers
• Control theory	design systems that maximize an objective function over time
• Linguistics	knowledge representation, grammar

Give the initial state, goal test, operators, path cost function for the 8
puzzle problem and write the state space diagram.



State space of the 8 puzzle problem

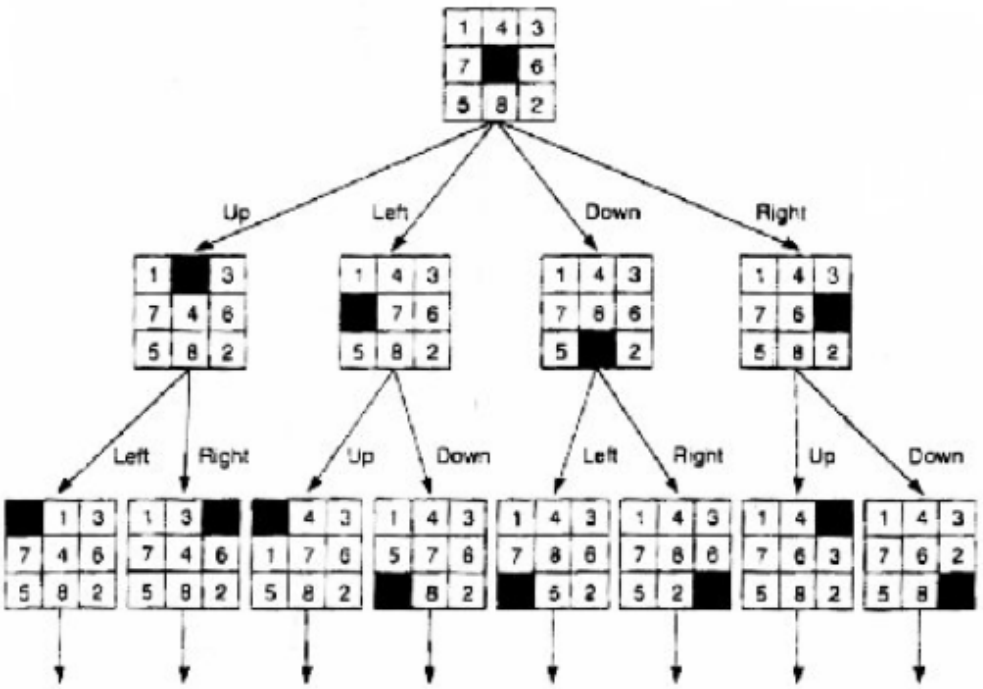


Figure 3.6 State space of the 8-puzzle generated by "move blank" operations.

Cost function: Each node X in the search tree is associated with a cost. The cost function is useful for determining the next E-node. The next E-node is the one with the least cost. The cost function is defined as

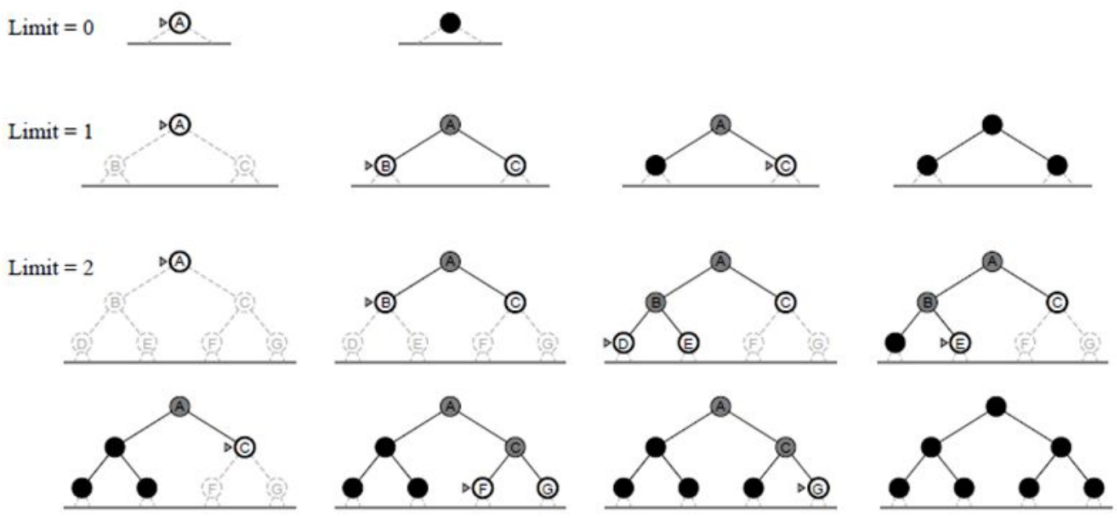
```
C(X) = g(X) + h(X) where
g(X) = cost of reaching the current node
       from the root
h(X) = cost of reaching an answer node from X.
```

Compare DFS and Iterative deepening DFS. Explain Iterative deepening DFS with an example.

- DFS is not guaranteed to find an optimal path; iterative deepening is.
- DFS may explore the entire graph before finding the target node; iterative deepening only does this if the distance between the start and end node is the maximum in the graph.
- BFS and iterative deepening both run in time $O(b^d)$, but iterative deepening likely has a higher constant factor.
- BFS uses $O(b^d)$ memory, while iterative deepening uses only O(d).

Comparing search strategies

Criterion	Breadth-First	Uniform-Cost	Depth-First	Depth-Limited	Iterative Deepening	Bidirectional (if applicable)
Complete?	Yes[a]	Yes[a,b]	No	No	Yes[a]	Yes[a,d]
Time	$O(b^d)$	$O(b^{1+\lfloor C^*/\epsilon \rfloor})$	$O(b^m)$	$O(b^\ell)$	$O(b^d)$	$O(b^{d/2})$
Space	$O(b^d)$	$O(b^{1+\lfloor C^*/\epsilon \rfloor})$	$O(bm)$	$O(b\ell)$	$O(bd)$	$O(b^{d/2})$
Optimal?	Yes[c]	Yes	No	No	Yes[c]	Yes[c,d]

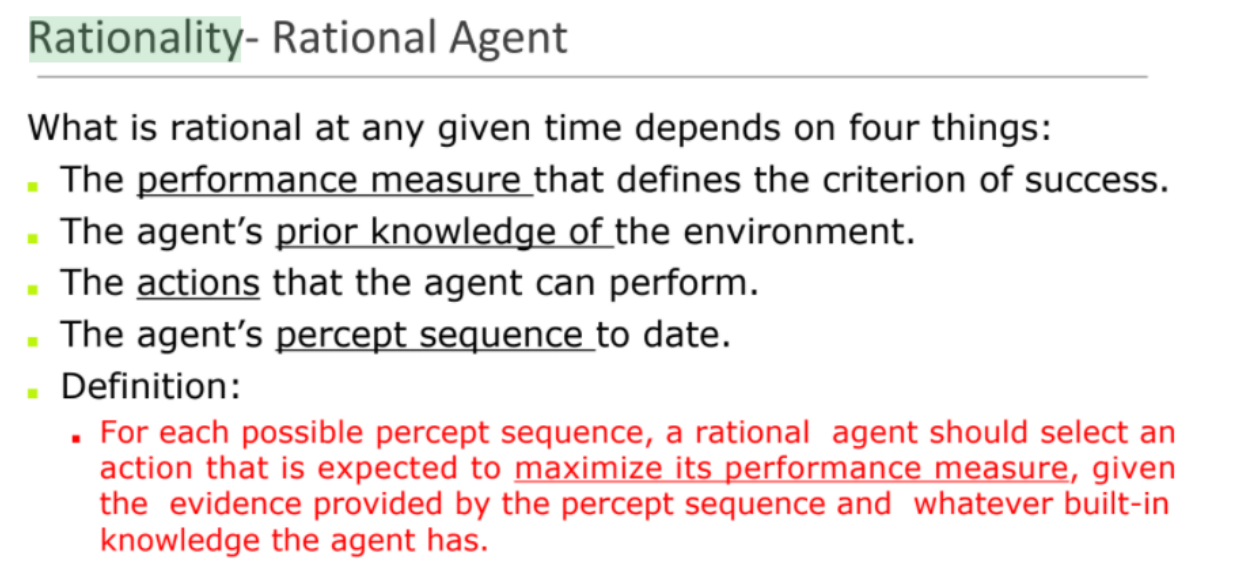


Define in your own words the following terms: artificial intelligence and rationality.

Artificial intelligence (AI) is the study of ideas that enable computers to be intelligent. The goals of the field of artificial intelligence are to make computers more useful and to understand the principles that make intelligence possible.

Rationality

An agent should "do the right thing", based on what it can perceive and the actions it can perform. The right action is the one that will cause the agent to be most successful.



Write the algorithm for Depth Limited Search and briefly explain the same with an example

Depth-Limited Search Algorithm

- A depth-limited search algorithm is similar to DFS with a predetermined limit.
- Depth-limited search can solve the drawback of the infinite path in the Depth-first search.
- In this algorithm, the node at the depth limit will treat as it has no successor nodes further.
- Depth-limited search can be terminated with two Conditions of failure:
  - Standard failure value: It indicates that problem does not have any solution.
  - Cutoff failure value: It defines no solution for the problem within a given depth limit.

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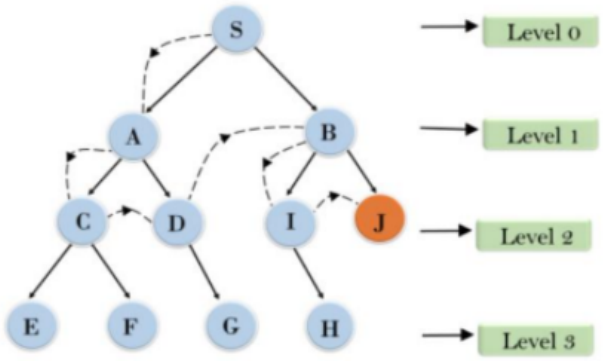
Example:Depth-Limited Search Algorithm



Properties of Depth-limited search

Completeness: Is complete if the solution is above the depth-limit.

Optimal: Depth-limited search can be viewed as a special case of DFS, and it is also not optimal even if $\ell > d$.

Time Complexity: Time complexity of DLS algorithm is $O(b^{\ell})$.

Space Complexity: Space complexity of DLS algorithm is $O(b\ell)$.

Define PEAS as applied to agents. Develop PEAS description of an agent that reports threat of tsunami activity. Determine what type of agent architecture is most appropriate (table lookup, simple Reflex, goal-based, or utility-based). Give a detailed explanation and justification of your choice.

- PEAS: **P**erformance, **E**nvironment, **A**ctuators, **S**ensors

P	**Performance** – how we measure the system's achievements
E	**Environment** – what the agent is interacting with
A	**Actuators** – what produces the outputs of the system
S	**Sensors** – what provides the inputs to the system

Tsunami Activity Reporter[1]	
Performance Measure:	Inform seismologists and coastal residents of the possibility and/or appending approach of a tsunami.
Environment:	Series of buoys (sea-level monitoring equipment) in the oceans of the world.
Actuators:	When readings match one of the recognized patterns of wave movement and related seismic activity has been detected, notify seismologists and residents of coastal areas which will most likely be affected by a possible significant event. Provide estimate of time it will take the tsunami to reach each potentially affected area, and estimate of wave height and intensity.
Sensors:	Continuous readings from sensors strategically placed throughout the world's oceans.

Determine what type of agent architecture is most appropriate (table lookup, simple reflex, goal-based, or utility-based). Give a detailed explanation and justification of your choice.

The patterns which the agent uses are matched against sets of events that occur over time.
Therefore, the agent needs to maintain knowledge of the past, and, thus, cannot be either a table lookup or simple reflex agent. If you assume that the patterns do not overlap and are clearly distinguishable from one another, then the agent could be viewed as goal-based. On the other hand, if you assume that the patterns do overlap, and that one must consider such factors as the likelihood of one event occurring over another, then the agent would be viewed as utility-based.

Explain PEAS and write the PEAS description for: i) Railway Reservation System ii) Interactive tutor for aptitude skills.

Subject Tutoring	Maximize scores, Improvement is students	Classroom, Desk, Chair, Board, Staff, Students	Smart displays, Corrections	Eyes, Ears, Notebooks

list any four most powerful AI companies and briefly discuss their contribution to the world.

Amazon

Trade giant Amazon has invested in both the consumer-oriented side of AI and in applications for companies and their processes. Alexa, the company's AI language assistant, integrated into its echo speaker series, is well-known worldwide. However,

Amazon Web Services (AWS), a set of machine learning programs and pre-trained AI services for businesses, hasn't yet done so much. AWS currently has more than 10,000 customers, including Siemens, Netflix, Tinder, NFL, and NASA.

Apple

Apple has been busy acquiring AI start-ups in recent years and sees Artificial Intelligence as a critical part of its future. In December 2018, the company officially appointed John Giannandrea as head of the AI and Machine Learning department after Google poached the Scottish computer scientist. He will oversee the development of products such as Siri and the company's new Create ML tool, which MacOS and iOS developers can use to create efficient and straightforward training courses for their apps.

Facebook

Artificial intelligence will be enormously powerful in the future. So it's no surprise that Facebook is investing in AI. Facebook's AI research group, known as FAIR, says it is committed to advancing the field of machine intelligence and developing new technologies to provide people with better ways to communicate. Mark Zuckerberg and Co. worked on a negotiation platform with two AIs called Alice and Bob, among other things, but ended the project after the couple began communicating in their secret language.

Google

Perhaps the largest and most important AI company on this list is also the most obvious. Google has acquired AI start-ups as if there were going to be no more soon. Over the past four years, Mountain View has created no fewer than twelve new artificial intelligence companies. The most important purchase was the $400 million deal for DeepMind, the board game playing Go champion. There is also Google's machine system TensorFlow, which is now free for all, and the ongoing Tensor AI chip project for machine learning on the device. Google's CEO, Sundar Pichai, has already mentioned that in the long run we are "evolving from a 'mobile first' to an 'AI-first' world in the computer industry," and that already says everything you need to know to see where Google sees the future.

Write the algorithms of Iterative Deeping search and Depth Limited Search. Compare their performance based on the parameters of completeness, time, space and optimality.

Criterion	GSDFS	TSDFS	ID
Completeness	For finite graphs	No	For finite b
Optimality	No	No	Yes
Time Complexity	$O(n_V + n_E)$	$O(b^m)$	$O(b^d)$
Space Complexity	$O(n_V)$	$O(bm)$	$O(bd)$