

Question #02:

(a)-

A Turing test is a deceptively simple method of determining whether a machine can demonstrate human intelligence.

If a machine can engage in a conversation with a human without being detected as a machine, it has demonstrated as human intelligence.

(b)-

If an algorithm is complete, it means that if at least one solution exists then the algorithm is guaranteed to find a solution in a finite amount of time.

If a solution is found for an algorithm is guaranteed to be the best solution (lowest path cost) among all other solutions, then such a solution is said to be an optimal solution.

(c)-

A problem can be analysed into more specific components.

- First of all it consists of two situations,
 - The present one which is called the initial state.
 - The desired one, which we can call the goal state.
- The agent's task is to get from the initial state to the goal state by means of series of actions that change the state.

The problem is solved if such a series of action has been found, and the goal has been reached. In general, problem solving is a component of goal-directed action or control.

(d)-

A useful measure of search efficiency is the effective branching factor, B . It describes how sharply a search process is focused toward the goal. Suppose that search finds a path of length d and generates

a total of ~~length~~ Nodes N. B is then equal to the number of successors of each node in that tree.

(e)-

A universal statement is a statement that is true if, and only if, it is true for every predicate variable within a given domain.

An existential statement is a statement that is true if there is at least one variable's domain for which the statement is true.

(D)-

The simplest best-first strategy is to minimize the estimated cost to reach the goal. i.e. always expand the node that appears to be closest to the goal.

A function that calculates cost estimates is called heuristic function.

$h(n)$ = estimated cost of the cheapest path from the state at n to a goal state.

A best-first search that uses h to select the next node to expand is called a greedy search.

(g)-

Plateau: On plateau all neighbours have same value. Hence, it is not possible to select the best direction.

Ridge: Any point on a ridge can look like peak because movement in all possible directions is downward.

(h)-

Procedural knowledge means how a particular thing can be accomplished, while Declarative knowledge means basic knowledge about something. Declarative knowledge is data-oriented in nature.

(i)-

Before an agent can start searching for solutions it must formulate a goal and then use the goal to formulate a problem. A problem consists of five parts:

- The space state
- An initial solution
- Actions
- A goal test
- Path costs.

A path from an initial state to a goal state is called a solution.

(j) -

A proposition is a declarative statement which is either true or false but not both at a time. While a predicate logic is an expression of one or more variables defined on some specific domain.

Question#02:

Clustering:

Clustering is the task of dividing the population or data points into a number of groups such that data points in the same groups are more similar than data points in other groups.

It is basically a collection of objects on the basis of similarity and dissimilarity between them.

Hierarchical Clustering

It divides the datasets into a number of clusters, where the user doesn't specify the number of clusters to be generated before training the model (also known as connectivity-based methods).

In this method, simple partitioning of the datasets will not be done, whereas it provides us with the hierarchy of the clusters that merge with each other after a certain distance. After

clustering is done on the dataset the result will be a tree-based representation of data points [dendrogram], which are divided into clusters.

Distribution Model-Based Clustering

In this type of clustering technique, clusters are formed by identifying by the probability of all the data points in the cluster come from the same distribution (Normal, Gaussian). The most popular algorithm in this type of technique is Expectation-Maximization(EM) clustering using Gaussian Mixture Models (GMM).

Density-Based Clustering:

Here clusters will be formed by segregation of various density regions based on different densities in the data plot. Density-Based ~~clustering~~ Spatial Clustering and Application with Noise (DBSCAN) is the most used algorithm in this type of technique. There should be a minimum

number of points that contains in the neighborhood of a given radius for each point in the cluster.

Fuzzy Clustering:

This type of clustering technique points close to the center, maybe a part of the other cluster to a higher degree ~~points~~ than points at the edge of the same cluster. The probability of a point belonging to a given ~~use~~ cluster is a value that lies between 0 to 1. The most popular algorithm in this type of technique is FCM (Fuzzy C-mean Algorithm). Here, the centroid of a cluster is calculated as the mean of all points, weighted by their probability of belonging to the cluster.

Partitioning Clustering:

It is a type of clustering technique, that divides the data set into a set number of groups. For example, the value of k in KNN and it will be decided before we train the model. It can be also

called a centroid-based method.

In this method, cluster center is formed such that the distance of data points of that cluster is minimum when calculated with other clusters centroid. A most popular example of this algorithm is the KNN algorithm.

Question#03

Techniques of knowledge Representation

There are mainly four techniques of knowledge representation which are as follows:

1. Logical Representation
2. Semantic Network Representation
3. Frame Representation
4. Production Rules

Logical Representation:

It is a language with some

concrete rules with deals with the propositions and has no ambiguity in representation. Logical representation means drawing a conclusion based on various conditions. This representation lay down some important communication rules.

It consists of precisely defined syntax and semantics which supports the sound inference. Each statement can be translated into logic using syntax and semantics.

Semantic Network Representation:

They are the alternatives of the predicate logic for knowledge representation. In semantic networks, we can represent our knowledge in the form of graphical networks. The networks consists of nodes representing objects and arcs which describes the relationship between those objects. Semantic networks can categorize the objects in different forms and

can also link those objects. They are very easy to understand and can be expanded easily.

Frame Representation:

A frame is a record like structure which consists of a collection of attributes and its values to describe an entity in the world. Frames are the AI data structures which can be divide the knowledge into substructures by representing stereotypes situations. It consists of a collection of slots and slot values. These slots may be of any type and sizes. Slots have names and values which are called parts.

Production Rules:

Production Rules system consists of (condition, action) pairs which mean, "if condition then action." It has mainly three parts:

- the set of production rules
- working memory
- the recognize-act- cycles

In production rules agent checks for the condition if the condition exists then production rule fires and corresponding action is carried out. The condition part of the rule determines which rule may be applied to a problem.

And the action part carries out the associated problem-solving steps. This complete process is a recognize-act-cycle. The working memory contains the description of the current state of problem-solving and rule can write knowledge to the working memory. The knowledge match and may fire other rules. If there is a new situation (state) generates, the multiple production rules will be fired together, this situation is called conflict set. In this situation the agent, called needs to select the rule from this set

and it is called a conflict resolution.

Question#04

PEAS stands for Performance, Measure, Environment, Actuator, Sensor.

Performance Measure:

It is the unit to define the success of an agent. Performance varies with agent based on their different precept.

Environment:

It is the surrounding of an agent at every instant. It keeps changing with time if the agent is set in motion. There are five major types of environments:

- fully Observable & Partially Observable
- Episodic & static
- static & Dynamic
- Discrete & continuous
- Deterministic & Stochastic

Actuator: It is a part of the agent that delivers the output of an action to the environment.

Sensor: They are the receptive parts of an agent which takes in the input from the agent.

Environments of an Agent:

Discrete / Continuous: If there are a limited number of distinct clearly defined states of the environment is discrete otherwise continuous

Observable / Partially Observable:

If it is possible to determine the complete state of the environment at each point of time from the percepts it is observable otherwise, partially observable.

Static / Dynamic: If the environment does not change while an agent is acting then it is static, otherwise dynamic

Deterministic / Non-Deterministic:

If the next state of the environment is completely determined by the current

state and action of the agent, then the environment is deterministic otherwise, it is non-deterministic.

Episodic / Non-Episodic:

In an episodic environment, each episode consists of the agent perceiving and then acting. The quality of its action depends just on the episode itself. Subsequent episodes does not depend on the actions in the previous episodes. Episodic environments are much simpler because the agent does not need to think ahead.

Question #05:

Convolution Neural Network:

A convolution neural network is a class of deep neural networks, most commonly applied to analysing visual imagery. The innovation of using the convolution operation in a neural network is that the values of the filter are weights to be learned during the training of the network.

Heuristic Function:

They are simply called heuristic, is a function that ranks alternatives in search algorithms at each branching step based on available information to decide which branch to follow.

Intelligent Personal Assistant:

It is a software agent that can perform tasks or services for an individual based on commands or questions.

Classification:

H is refers to a predictive modelling problem where a class label is predicted for a given example of input data.

Uniform Cost Search:

It is a searching algorithm used for ~~travelling~~ traversing a graph or tree. The primary goal of this is to find a path of the goal which has the lowest cumulative cost.

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Question #06:

Missionaries & Cannibals problem:

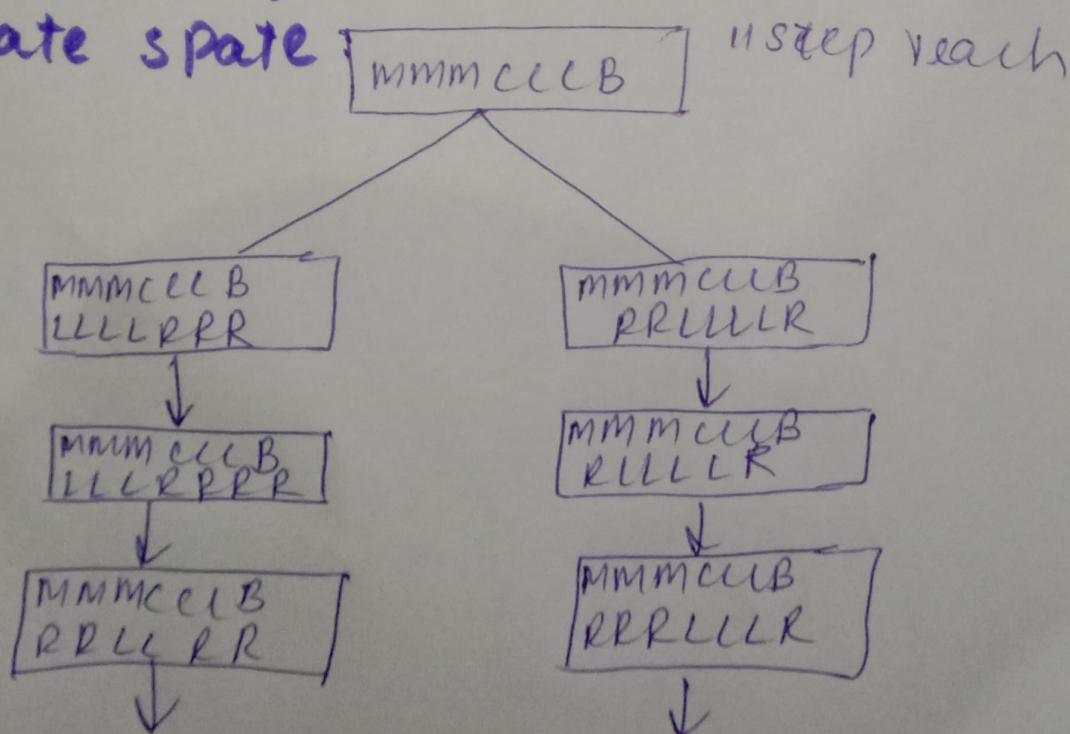
- 3 Missionaries and 3 cannibals were on one side of the river.
- All want to cross the river.
- On same side of the river missionaries count cannot be less than cannibals.
- Only one boat available that can hold two people at a time.

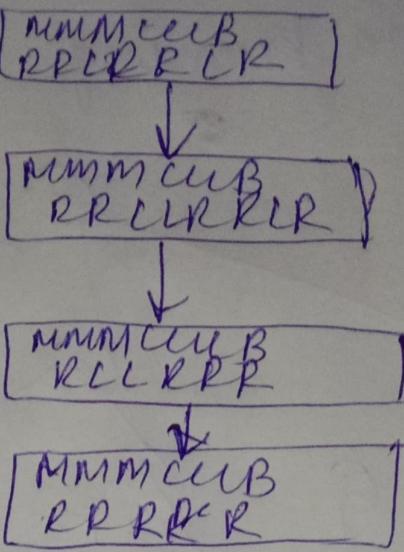
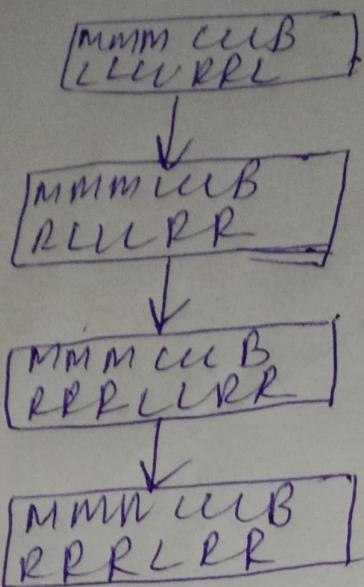
initial state: $\langle 1, 3, 3 \rangle \langle 2, 0, 0 \rangle$

Set of Actions: (R, m, c) (left; Right)
river ↓ ↓ ↓
 missionaries cannibals

Transition Model:

state space

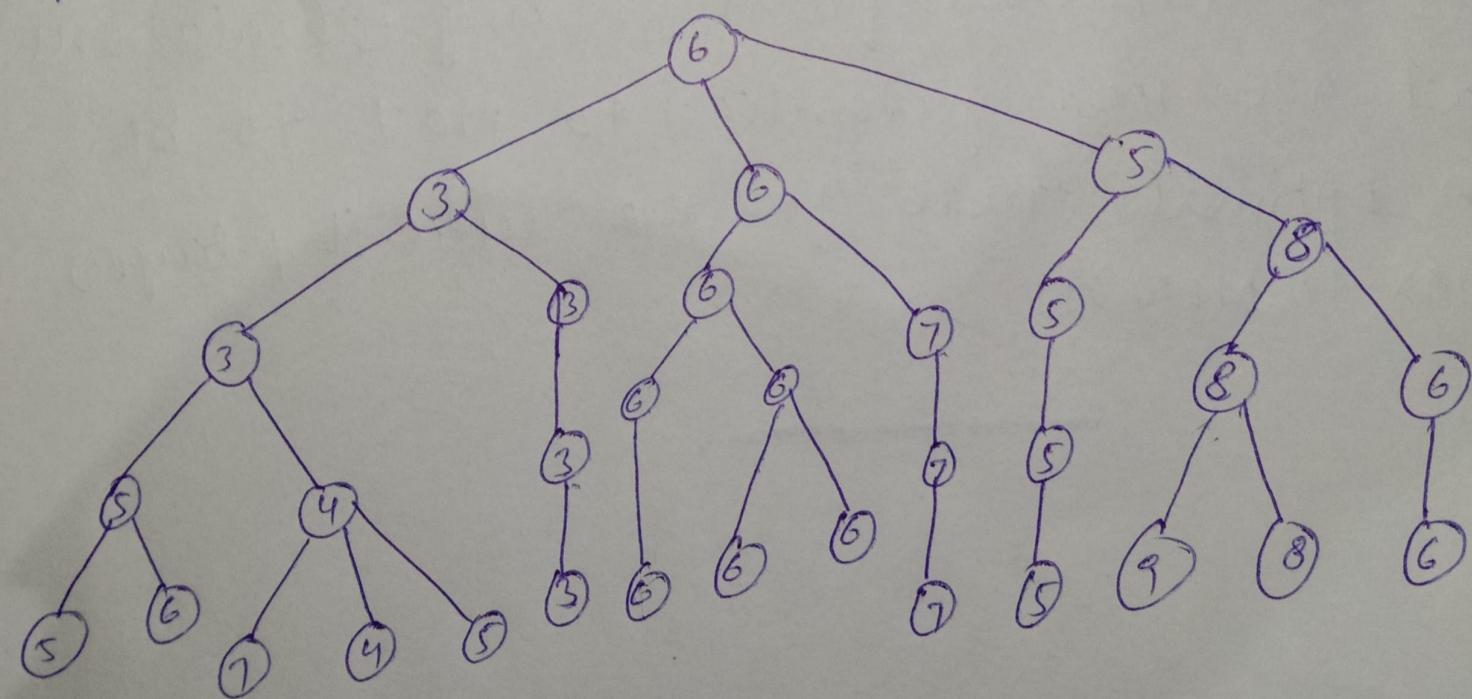




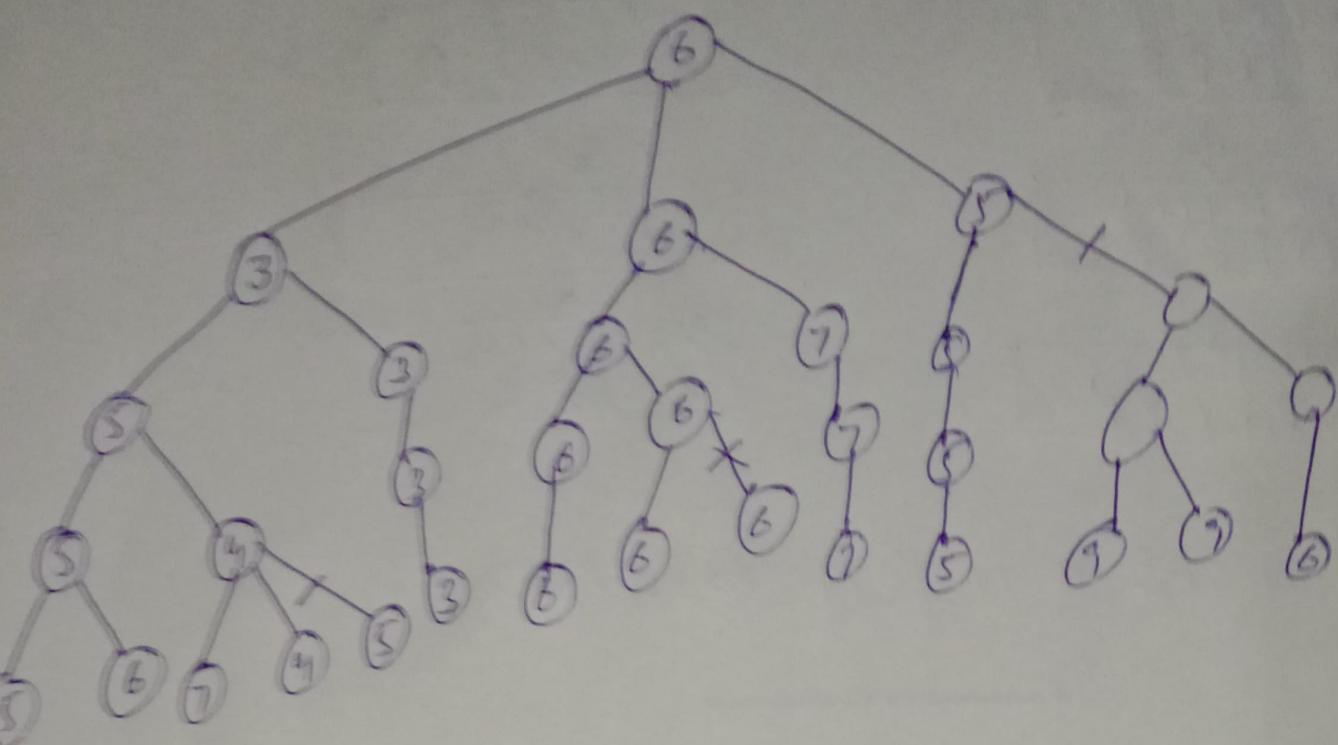
Path cost: the cost of each step is 11.

Q#07:

MiniMax:



Alpha-Beta Pruning:



Alpha-Beta and minimax returned the same answer. All alpha-beta did is to prevent minimax from making calculations that are 100% guaranteed to NOT to be an optimal state for the current player (MAX to MIN).
