SUTD 50.021 AI

Week 01: Search

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Question 1 (Environment Types)

1. Playing a massively multiplayer online game, such as World of Warcraft

   - **Partially observable** as the game has different map locations, the agent only has access to the state of the environment for the current location;
   - **Strategic** as these games involves quests that are often planned out with a chain of set events such that if a player chooses an option, the next state is always the same. However, the game is multiplayer; hence the actions of other agents are not deterministic;
   - Episodic:
   - **Dynamic** as the game environment is constantly changing even when the agent (player) is Away-From-Keyboard (AFK) and deliberating;
   - **Continuous** as the agent can move around in the game and there are countless interactions and actions;
   - **Multi-agent** the game itself is multiplayer. Hence, there are other agents.

2. Buying a movie ticket online

   - **Fully observable** as we can see all the possible seating for that movie;
   - **Deterministic** as the environment is not random, the seat is changed to chosen if an agent chooses it;
   - Episodic:
   - **Dynamic** as the environment is constantly updating. While the agent is choosing the seat, other agents might also choose seats, which returns an error as the seat will be reserved;
   - **Discrete** as there is a finite number of states which is the combinations of the seats being chosen/reserved/available;
   - **Multi-agent** as there might be other agents also aiming to choose their optimal seat.

3. Planning a holiday itinerary with your friends (assuming planning includes the bookings of the itinerary)

   - Observable:
   - Deterministic:
   - Episodic:
   - **Dynamic** as the environment is constantly updating as the booking sites are live updated;
   - **Continuous** as there are countless many options when planning what to do in a holiday;
   - **Multi-agent** as there might be other agents also planning a holiday itinerary too.

Question 2 (Formulation)

> Three missionaries and three cannibals are on one side of the river. They all need to cross in a boat that only holds two people at once. There must never be a situation where there is a group of missionaries in one place who are outnumbered by cannibals.

Assuming they are crossing over from the left to the right side.

1. **Statespace:**
   An array representation: [No. of missionaries yet to cross, No. of cannibals yet to cross, Current Boat location (0: right side, 1: left side)];

2. **Initial state:**
   Initially there are 3 missionaries and 3 cannibals who have yet to cross. The boat is on the left side. Array: [3,3,1];

3. **Actions**
   Actions are represented by an array too: [No. of missionaries crossing, No. of cannibals crossing, Current Boat location (0: right side, 1: left side)];
   Therefore are 5 possible actions for each current boat location: [1,0,0/1], [2,0,0/1], [0,1,0/1], [0,2,0/1] and [1,1,0/1].;

4. **Transition Model**
   Alternating subtraction and addition of the 5 possible actions, starting from subtraction from the initial state until our goal test is reached. For each node expansion, children nodes that violate the situation where there is a group of missionaries in one place who are outnumbered by cannibals is dropped. For example from the initial state, the only valid children nodes are: [3,2,0], [3,1,0] and [2,2,0];

5. **Goal test**
   To obtain a goal state of [0,0,0] where there are 0 missionaries and cannibals who have yet to cross, hence implying all have crossed over. The boat is on the right side after ferrying the last time;

Question 3 (General Search)

1. **Difference between a node and a state:**

   A state which is a physical configuration does not have a parent, children, depth or path cost unlike a node which is a data structure constituting part of a search tree.

2. **Briefly describe what is a search strategy:**

   Starting at an intial, root node of the search tree, a search strategy is the picking of the order of the node expansion.

3. **Describe the difference between Tree Search and Graph Search:**

   During the node expasion, a tree search does not keep track of the previously visited states unlike a graph search.