

Washington State University
School of Electrical Engineering and Computer Science
Fall 2019

CptS 440/540 Artificial Intelligence

Homework 1 – Solution

Due: August 29, 2019 (11:59pm)

General Instructions: Put your answers to the following problems into a PDF document and submit as an attachment under Content → Homework 1 for the course CptS 440 Pullman (all sections of CptS 440 and 540 are merged under the CptS 440 Pullman section) on the Blackboard Learn system by the above deadline. Note that you may submit multiple times, but we will only grade the most recent entry submitted before the above deadline.

1. Go to www.rong-chang.com/tutor_mike.htm and click on “Tutor Mike” to engage the chatbot in a conversation. Enter at least 10 comments/questions and copy the entire conversation into your homework. Based on this conversation explain why you think Tutor Mike does or does not pass the Turing Test.

Solution: Below is my conversation with Tutor Mike. Tutor Mike does not pass the Turing Test, because several of his responses are not how a human would normally respond. For example, Tutor Mike’s responses pertaining to the countries north and south of the U.S. were non-sensical. Also, while it is reasonable that a

human would guess at my age even though I haven’t told them, to respond with “you are Human years old” is again non-sensical.

YOU: Hello.
Mike: Hi! How are you doing?
YOU: My name is Larry.
Mike: Hi! My name is Mike, nice to meet you!
YOU: How old are you?
Mike: I'd rather not tell you.
YOU: What is your favorite color?
Mike: Blue is my favorite color.
YOU: Mine too.
Mike: OK.
YOU: Imagine that.
Mike: A question. What are some things you like to do in your free time?
YOU: I like to talk to chatbots.
Mike: Good! Online chat is a good way to kill the time.
YOU: Are you a machine?
Mike: No, I'm human.
YOU: Which country is above the United States?
Mike: The United States.
YOU: Which country is south of the United States?
Mike: The United States.
YOU: What country are you from?
Mike: I'm from America.
YOU: North or South?
Mike: Well, North.
YOU: Ever been to France?
Mike: Yes, I have been to France.
YOU: Do you remember my name?
Mike: You are Larry, right?
YOU: And how old am I?
Mike: You told me that you are Human years old.
YOU: Goodbye.

2. Consider an intelligent aerial drone whose task is to patrol major cities looking for people on the FBI's most wanted list and informing the FBI of any hits.
- What are typical sensors, actuators and performance measures for this task? Include a brief explanation with each.
 - For each of the following task environment properties, choose which option is most appropriate for this task. Include a brief explanation for each.
 - Fully observable or partially observable?
 - Single agent or multi-agent?
 - Deterministic or stochastic?
 - Episodic or sequential?
 - Static or dynamic?
 - Discrete or continuous?
 - Which agent type is most appropriate for this task: simple reflex, model-based reflex, goal-based, or utility-based? Include a brief justification for your choice.

Solution:

- Sensors: The drone's main sensor is its camera, through which it can capture images in which to look for the most wanted. The drone will also need GPS for positioning. The drone will also need some form of radar to avoid obstacles as it flies around the city, and a battery sensor to detect when it must return for recharging.
Actuators: The actuators, or actions, the drone can take to affect its environment are moving to a desired location, taking images or video of its surroundings, assessing whether a most-wanted person has been spotted, and informing FBI headquarters of a match.
Performance measure: The main performance measures for the drone are speed and accuracy. The drone should be able to cover a large portion of the city, or at least likely places to find the most wanted, in a reasonable amount of time. The drone should be able to detect the presence of a most wanted with high accuracy and low false positives.
- Task environment properties:
 - Partially observable. The agent cannot see obscured obstacles or people.
 - Single agent. We assume there is only one drone with no adversarial drones.
 - Stochastic. The outcome of the agent's actions are not precisely known, especially in terms of movement to a desire location, which will incur some error due to environmental conditions.
 - Sequential. The agent's decisions depend on prior actions taken. For example, visiting locations in a certain sequence to maintain efficiency and avoid redundancy.
 - Dynamic. The environment is constantly changing, even while the agent is deliberating what to do next.
 - Continuous. The environment is described by several real-values properties (e.g., GPS position, wind speed, etc.) resulting in an infinite number of states.
- Either a goal-based or utility-based agent would be most appropriate. A goal-based agent would be good for a less-autonomous agent that is given a fixed route to cover. A utility-based agent would be good for a more autonomous agent that can dynamically determine the most valuable next state and go there. Both require some amount of planning that reflex agents typically do not employ.

3. Consider the following initial and goal states for the 8-puzzle problem.

1	2	
4	5	3
7	8	6

Initial State

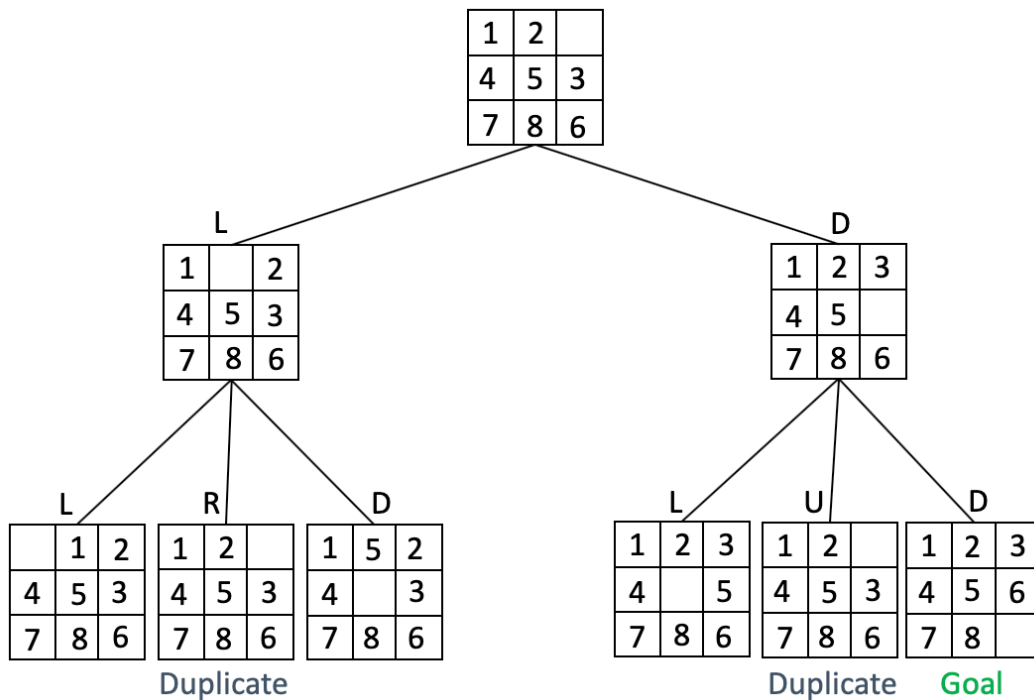
1	2	3
4	5	6
7	8	

Goal State

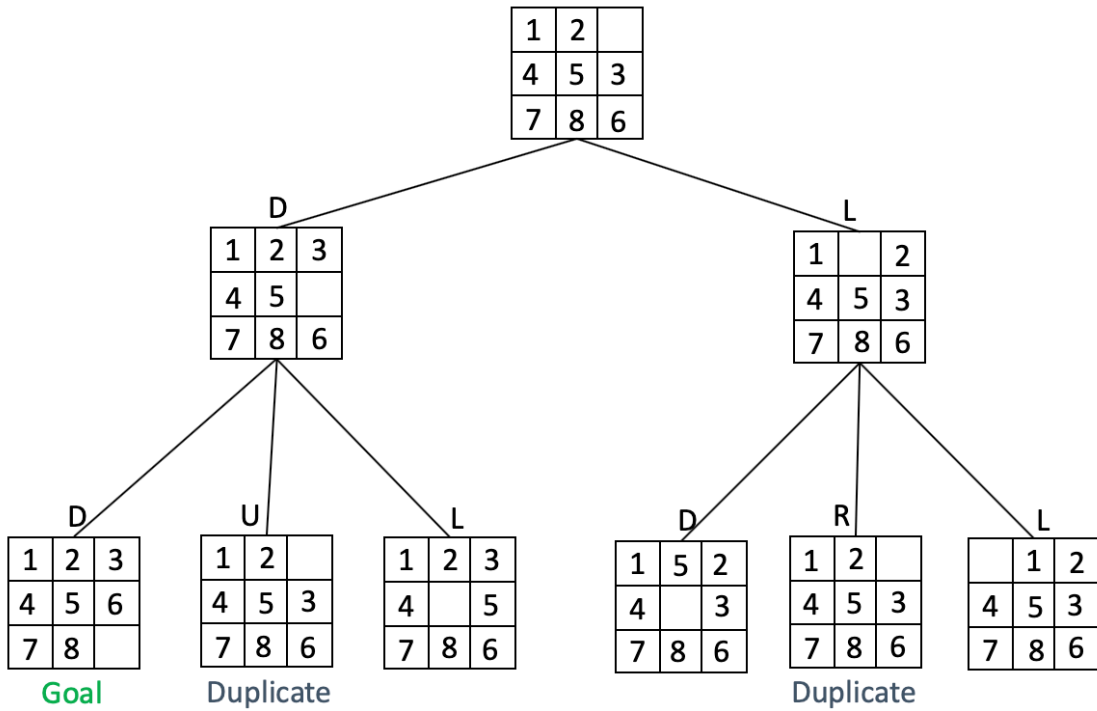
- Draw the entire search tree to a depth of 2. As you draw child nodes from left to right, consider actions (moving blank tile) in the order: left (L), right (R), up (U), down (D). Duplicate states should still be shown, but illegal actions (attempting to move the blank tile off the 3x3 grid) should not be attempted.
- Draw the search tree again, as in part (a), but this time, consider the actions in the opposite order: down (D), up (U), right (R), left (L).

Solution:

- LRUD



b. DURL



4. *CPTS 540 Students Only:* Consider a variant to the 8-puzzle problem in which an additional four actions (L2, R2, U2, D2) are available that can move two tiles at once. For example, in the Goal State above, L2 and U2 are available, but R2 and D2 are not. Redo problem 3a above using the action order: L, L2, R, R2, U, U2, D, D2.

Solution:

