

Student name: _____

Student ID: _____

Question 1 [Agents, Chapter 2] (14 points):

1A) [6 points] Both the performance measure and the utility function measures how well an agent is doing. Explain how they are different

1B) [4 points] Why do you not need to be omniscient to be a rational agent?

1C) [4 points] Can a simple reflex agent be rational in its environment? Explain.

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Question 2 [Search, Ch 3] (10 points):

Consider the problem where you have a 3, 5 and 9 liter jug and need to get 7 liters exactly into the 9 liter jug:

2A) [6 points] How many leafs are there in the search tree to a depth of K , if you allow loops and actions that do not change the 'state' of the world? (leaf=node at the bottom level of the tree)

2A*) Bonus [5 points]: How many distinct states can you visit when $K=3$? Show the search tree and highlight the distinct states.

2B) [4 points] Can you get a total of any number of liters from 1 to 17 ($3+5+9$)? List, for 1 ... 16 (except 3,5,9) the solution for getting from 0,0,0 to a goal that sums up to that particular value (or write NA if not possible):

- 1: (0,0,0) → _____
- 2: (0,0,0) → _____
- 4: (0,0,0) → _____
- 6: (0,0,0) → _____
- 7: (0,0,0) → _____
- 8: (0,0,0) → _____
- 10: (0,0,0) → _____
- 11: (0,0,0) → _____
- 12: (0,0,0) → _____
- 13: (0,0,0) → _____
- 14: (0,0,0) → _____
- 15: (0,0,0) → _____
- 16: (0,0,0) → _____

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Question 3 [Search, Chapter 3] (20 points):

The **missionaries and cannibals** problem is usually stated as follows: Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side, without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place.

3A) [16 points] Formulate the problem precisely, making only those distinctions necessary to ensure a valid solution. Draw a diagram of the complete state space.

3B) [4 points] What is the solution, given your initial state (all one one side, needing to get to the other)? Highlight the path in your state space diagram.

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Question 4 [Informed Search, Chapter 4] (6 points):

4A) [6 points] Can A* work on a search space where some actions decrease the cost from the initial state (i.e., the action has a negative cost). Explain.