IN-CLASS EXERCISE (I1)

Student ID:..... Duration: 15 mins Date: 14/06/2023

Student name: ..... Score: ...../ 3

Question 1 (2pts) Consider the following scenario. *The agent being considered is an old calligrapher, who is drawing calligraphy pictures for visitors coming to the traditional culture exhibition. As a part of his effort for better concentration and creativity, he listens to some Zen music and sometimes hums an ancient poem while drawing.*

Identify the following task environment properties of the above scenario. Do not forget to give your explanation for every dimension. *Note that a wrong explanation will give you 0 credit for the corresponding property.*

○ **Fully observable** ○ **Partially observable** **Explanation:** .....

.....

○ **Single-agent** ○ **Multi-agents** **Explanation:** .....

.....

○ **Stochastic** ○ **Deterministic** **Explanation:** .....

.....

○ **Episodic** ○ **Sequential** **Explanation:** .....

.....

Question 2 (1pt) Point out the key differences between tree-search and graph-search strategies.

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Specify the PEAS description for the above scenario. * Note: for A and S, please briefly indicate the functionalities of the actuator/sensor, e.g., hands (to write).

P: .....

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E: .....

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A: .....

.....

S: .....

.....

Question 2 (1pt) What is the use of explore set in graph-search strategies? How do you implement it? Why is that implementation efficient?

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Question 1 (2pts) Consider the following scenario. *The agent being considered is a traffic police, who is solving the traffic jam at a crowded crossroad. He stands on a podium at the centre of the intersection and shows his hand gestures to indicate that vehicles of which side can move and how they move. Sometimes, he must shout out loudly to get attention from drivers.*

Identify the following task environment properties of the above scenario. Do not forget to give your explanation for every dimension. *Note that a wrong explanation will give you 0 credit for the corresponding property.*

○ **Fully observable** ○ **Partially observable** **Explanation:** .....

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○ **Episodic** ○ **Sequential** **Explanation:** .....

.....

Question 2 (1pt) What is the number of states in the state space of the 8-puzzles problem? Explain.

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Specify the PEAS description for the above scenario. * Note: for A and S, please briefly indicate the functionalities of the actuator/sensor, e.g., hands (to write).

P: .....

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E: .....

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A: .....

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S: .....

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Question 2 (1pt) What is the number of states in the state space of the 8-queens problem? Explain.

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SOLUTION

IN-CLASS EXERCISE (I1)

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Question 1 (2pts) Consider the following scenario. *The agent being considered is an old calligrapher, who is drawing calligraphy pictures for visitors coming to the traditional culture exhibition. As a part of his effort for better concentration and creativity, he listens to some Zen music and sometimes hums an ancient poem while drawing.*

Identify the following task environment properties of the above scenario. Do not forget to give your explanation for every dimension. *Note that a wrong explanation will give you 0 credit for the corresponding property.*

◉ **Fully observable** ○ **Partially observable** **Explanation:** He can access to any part of the paper to accomplish his drawing and there is no hidden information in that environment

◉ **Single-agent** ○ **Multi-agents** **Explanation:** Only the calligrapher does the task. The visitors may give the requirements once at the beginning but they have no effect during the drawing process.

○ **Stochastic** ◉ **Deterministic** **Explanation:** This old calligrapher is professional enough to control his writing brush to achieve the designated hand-written character

○ **Episodic** ◉ **Sequential** **Explanation:** A Chinese / artistical character is a series of stroke (these strokes must be drawn in a specific order)

Question 2 (1pt) Point out the key differences between tree-search and graph-search strategies.

Graph search additionally maintains an explored set to store visited nodes while tree search does not. Thus, graph search prohibit revisiting a state, while tree search may visit the same state multiple times by different paths. This may cause a suboptimal solution when using graph search A* with an admissible heuristic, because there may be a better path to a state in the explored set.

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Specify the PEAS description for the above scenario. * Note: for A and S, please briefly indicate the functionalities of the actuator/sensor, e.g., hands (to write).

P: A creative and artistical calligraphy picture that meets the expectation of a visitor

E: Must have: Zen music, many other calligraphy pictures, drawing tools (absorbent paper, writing brushes and ink), visitors In the traditional culture exhibition

A: Must have: Hands (to draw), mouth (to hum a poem)

S: Must have: Eyes (to observe what has been drawing), ear (to listen to Zen music)

Question 2 (1pt) What is the use of explore set in graph-search strategies? How do you implement it? Why is that implementation efficient?

The explore set stores nodes that are expanded during the search; a graph-search algorithm cannot revisit a node if it is already in the explored set. The explore set should allow for fast lookup, and thus it should be a hash table or something equivalent.

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Question 1 (2pts) Consider the following scenario. *The agent being considered is a traffic police, who is solving the traffic jam at a crowded crossroad. He stands on a podium at the centre of the intersection and shows his hand gestures to indicate that vehicles of which side can move and how they move. Sometimes, he must shout out loudly to get attention from drivers.*

Identify the following task environment properties of the above scenario. Do not forget to give your explanation for every dimension. *Note that a wrong explanation will give you 0 credit for the corresponding property.*

○ **Fully observable** ◉ **Partially observable** **Explanation**: The traffic police stands on a podium at the center of the intersection, yet he can only observe a certain range of view due to the limitation of human eyes.

○ **Single-agent** ◉ **Multi-agents** **Explanation:** The drivers adjust their behaviors following the police's directions; however, the police may need to alter his hand gestures to fix the drivers' bad actions

◉ **Stochastic** ○ **Deterministic** **Explanation:** Traffic jam is a practical scenario and the behaviors of drivers are complicated. The police absolutely has no way to foresee and control those behaviors

○ **Episodic** ◉ **Sequential** **Explanation:** The crowd must follow a series of hand gestures from the police to continously adjust their behaviors; in the way, the traffic jam is resolved.

Question 2 (1pt) What is the number of states in the state space of the 8-puzzles problem? Explain.

9! There are 9 choices to put the first tile, 8 choices to put the second tile, and so on. The last cell is left empty. Thus, $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 = 9!$

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Specify the PEAS description for the above scenario. * Note: for A and S, please briefly indicate the functionalities of the actuator/sensor, e.g., hands (to write).

P: The traffic jam is resolved. Vehicles of any side can move properly.

E: Must have: Streets, traffic lights, podium, cars and drivers

A: Must have: hands (to show hand gestures), mouth (to shout out loudly)

S: Must have: eyes (to see the streets), ear (to hear the drivers' responses and the vehicles' horns)

Question 2 (1pt) What is the number of states in the state space of the 8-queens problem? Explain.

It depends on the state formulation.

Assume that each queen is in a separate column. The number of states in the state space is $\mathbf{8^8}$. Each queen has 8 choices for a row. There are 8 queens, each of which has 8 chocies. Thus, $8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 = 8^8$.

Assume that each queen can be in any cell on the board. The first queen has 64 choices, the second queen has 63 choices, and so on. Thus, $64 \times 63 \times 62 \times 61 \times 60 \times 59 \times 58 \times 57 = 1.78 \times 10^{14}$