Assignment 1

Introduction to Artificial Intelligence and Logic Programming

Winter 2024

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## **Instructions**

* This is an individual assignment.
* Copying another person’s work is a breach of the academic integrity policy.
* Check eclass for due date and time.
* After completing this assignment, submit only the answer file.

**Do no alter the format of this answer file and do not omit any of the text in this file.**

**Part 1 – Uniformed Search**

**Question 1**

**Answer Format:** For the question below, type your answer in this format: **Start-A-B-C-D-E-F-Goal**. Do not explain your answer.

(Q.1.a) Depth-first graph search.

States Expanded (5 Marks):

Start-A-C-D-Goal

Path Returned (5 Marks):

Start-A-C-D-Goal

(Q.1.b) Breadth-first graph search.

States Expanded (5 Marks):

Start

A-B-D

C-D-Goal

Path Returned (5 Marks):

Start-D-Goal

(Q.1.c) Uniform cost graph search.

States Expanded (5 Marks):

Start(0)-A(2)

B(3)

D(5)

C(6)-D(7)

G(8)

Path Returned (5 Marks):

Start-A-C-G

**Question 2**

**Answer Format:** For the question below, type **True, False, Yes, or No** based on what the question is asking. Do not explain your answer.

**(Q2.a.1)** (5 Marks): true

**(Q2.a.2)** (5 Marks): true

**(Q2.a.3)** (5 Marks): true

**(Q2.a.4)** (5 Marks): yes

**(Q2.b.1)** (15 Marks)

**Answer Format:** List only the numbers, e.g., 1, 2, 3, 4, 5 then explain your answer for each item whether needed or not.

Answer:

4: necessary, to count how many visits has made so far for each of state. If the state which is being visited next has count of 2 in the array, this means that the goal is found.

1: necessary, to retrieve the count of visits from the array in #4 and figure out if this visit is the third time or not.

2: unnecessary, this is not a problem to find the shortest path. Number of edges traversed means nothing.

3: unnecessary, this functionality is already included in the option #4. The count of 0 indicates the state is never visited, if it is greater than 0, the state is visited at least once.

5: unnecessary, this functionality is already included in the option #4. # of distinct states that has been visited = # of elements in the array that are not 0

**Part 2 – Informed Search**

**Question 3**

**Answer Format:** For the question below, type your answer in this format: **Start-A-B-C-D-E-F-Goal**. Do not explain your answer.

Returned Path (10 Marks):

Start-A-C-Goal

**Question 4**

**(Q4.1)** (10 Marks):

M\*N

**(Q4.2)** (15 Marks): **Answer Format:** Answer yes or no, then give a specific example to support your answer. Answering yes or not alone without a supporting example will receive zero marks.

The measurement of the cost in this situation is the time taken to reach to the goal from the starting point. Then, the actual cost is minimized in the following conditions:

1. The agent makes a minimum number of either left or right turns.
2. The agent performs a minimum number of decelerations.
3. The agent maintains the velocity as fast as possible while it is heading to the goal.

The third condition has great importance because the agent can move more than one position depending on the current velocity within 1 unit of time. However, Manhattan distance regards only the distance between the starting point and the goal but not the time to reach the goal.

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Consider the 6X6 state space with no wall inside above where > is the agent facing east with current velocity of 0 and X is the goal. Assume that the agent’s current coordinate is (0,0) while the goal is at (6,6). Then, the Manhattan distance yields |6-0|+|6-0| = 12. This means it is assumed that the agent spends 1 unit of time to move to the adjacent position regardless of the direction it is facing or the current velocity. On the other hand, the actual cost, as unit of time t, would be as follows:

1. At t = 0, the agent accelerates, velocity becomes 1 and now the agent is at (1,0)
2. At t = 1, the agent accelerates, velocity becomes 2 and it is at (3,0)
3. At t = 2, the agent decelerates, velocity becomes 1 and it is at (4,0)
4. At t = 3, the agent decelerates, velocity becomes 0 and it is at (5,0)
5. At t = 4, the agent turns left, facing north and velocity is 0, position is (5,0)
6. At t = 5, the agent accelerates, velocity becomes 1 and it is at (5,1)
7. At t = 6, the agent accelerates, velocity becomes 2 and it is at (5,3)
8. At t = 7, the agent decelerates, velocity becomes 1 and it is at (5,4)
9. At t = 8, the agent decelerates, velocity becomes 0 and it reaches the goal.

1. The majority of this assignment is put together from material and questions provided by the authors of the textbook under an educational use license: All materials provided on this website are freely available for educational use <http://ai.berkeley.edu/instructors_guide.html> . [↑](#footnote-ref-1)