# Assignment 2

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**Qusetion1：**

**(a)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Position | Start1 | Start2 | Start3 | Start4 | Start5 |
| N | 41 | 173 | 2409 | 9508 | 58419 |

Breadth first search, exclude repeated states:

**(b)**Breadth first search, include repeated states:

|  |  |  |
| --- | --- | --- |
| Position | Start1(N=) | Start2 |
| N | 139 | 1857 |

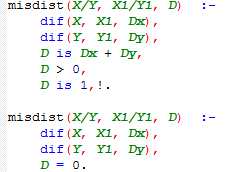
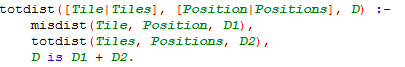
**(c)**

A\* with total Manhattan distance heuristic:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Position | Start1 | Start2 | Start3 | Start4 | Start5 |
| N | 6 | 11 | 19 | 61 | 213 |

**(d)**   
A\* with Misplace Tiles heuristic:

Changed parts:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Position | Start1 | Start2 | Start3 | Start4 | Start5 |
| N | 20 | 34 | 768 | Run out of time | Run out of time |

**(e)**   
Base on this result, the order from slowest to fastest is **c>a>b>d.**

**(f)**

**Position:**

|  |  |  |
| --- | --- | --- |
| 5 | 7 | 4 |
| 8 | 2 |  |
| 6 | 3 | 1 |

**Requiring 20: Requiring 23: Requiring 26:**

|  |  |  |
| --- | --- | --- |
| 5 | 7 | 4 |
| 8 | 2 | 1 |
|  | 6 | 3 |

|  |  |  |
| --- | --- | --- |
|  | 5 | 7 |
| 8 | 2 | 4 |
| 6 | 3 | 1 |

With A\* Manhattan Distance heuristic

|  |  |  |  |
| --- | --- | --- | --- |
| Requiring steps | **20** | **23** | **26** |
| N | 153 | 336 | 1305 |

**Qusetion2：**

**(a)**

**(b)**

1. **No**, the Straight-Line-Distance heuristic can be used for any direction. But diagonally move can just move by 45o. and even the degree is 45, the distance is not same, Straight-Line-Distance heuristic is , the other is 1.
2. **No**, because the agent can move diagonally. For example, if the agent moves from (0,0) to (1,1), for (a) heuristic, it cost 2 steps. While in (b) heuristic, it cost just one step.

**Qusetion3：**

|  |  |  |
| --- | --- | --- |
| n | time | sequence |
| 11 | 7 | [+ + + - o - -] |
| 12 | 7 | [+ + + o - - -] |
| 13 | 8 | [+ + + o - - o -] |
| 14 | 8 | [+ + + o - o - -] |
| 15 | 8 | [+ + + o o - - -] |
| 16 | 8 | [+ + + + - - - -] |
| 17 | 9 | [+ + + + - - - o -] |
| 18 | 9 | [+ + + + - - o - -] |
| 19 | 9 | [+ + + + - o - - -] |
| 20 | 9 | [+ + + + o - - - -] |
| 21 | 10 | [+ + + + o - - - o -] |

(a)

|  |  |  |
| --- | --- | --- |
| N | Time | sequence |
| 1 | 2 | [+ -] |
| 2 | 3 | [+ o -] |
| 3 | 4 | [+ o o -] |
| 4 | 4 | [+ + - -] |
| 5 | 5 | [+ + - o -] |
| 6 | 5 | [+ + o - -] |
| 7 | 6 | [+ + o – o - ] |
| 8 | 6 | [+ + o o - -] |
| 9 | 6 | [+ + + - - -] |
| 10 | 7 | [+ + + - - o -] |

(b)

The fastest way to get to the final is accelerate at the highest speed and slow down.

s is distance, a is acceleration, t is time. For initial speed is 0.

Because in this question, final speed must be 0.

t1 is accelerate time, t2 is slow down time

because speed from 0 to 0. t1 = t2. Let t = t1 +t2:

M(n,0) is the time t. n is the distant s, and in this question . let them take place of s and t, the least time used is:

In this question, all the things are discrete. So M(n,0) must be integer so:

(c)

As same as (b), just change the first formula to:

a = 1

Because it is discrete, the speed change need one step: