Time complexity

a star search time complexity, with manhattan heuristic

O(b^average solution depth)

MSA O(b^average solution depth) \* O(N)

Find neighbor iteration

For every node, get distance, compare with the max distance.

Table

Description automatically generated

MSA\*

Average search depth

Each iteration:

pseudocode

O(b^4)

Text

Description automatically generated

Since the neibor for each node is unknown.

(N\*N\*1)^4

Experience results:

Problem with A\*

Static, high variance

Mean, max, min

1. all use a\*, minimum moving time: t=1s.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Total travel time  Flying time + delay time | move-step | Mean Length of the path |
| **10** | **1456** | **1022** | **508.7** |
| **20** | **2829** | **1137** | **595.3** |
| **30** | **3789** | **1097** | **599.86** |
| **40** | **5985** | **1365** | **639.87** |
| **50** | **6215** | **1287** | **640.28** |

2. all use msa\*, very poor performance, alpha, beta choice

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Total search time | move-step | Mean Length of the path | Fail rate |
| 10 | **719** | **718** | **412.2** |  |
| 20 | **734** | **718** | **432** |  |
| 30 | **801** | **718** | **417.5** |  |
| 40 | **882** | **718** | **437** |  |
| 50 | **974** | **718** | **437** |  |

3, mix a\* and msa\*, use a\* if you can report under t=5s, otherwise, switch to msa\*.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Total travel time | move-step | Mean Length of the path |
| 10 | **719** | **718** | **412.2** |
| 20 | **1021** | **679** | **448.25** |
| 30 | **1276** | **679** | **443.96** |
| 40 | **1592** | **719** | **456.35** |
| 50 | **1965** | **771** | **487.3** |

Special designed map

1. all use a\*, minimum moving time: t=1s.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Total travel time  Flying time + delay time | move-step | Mean Length of the path |
| **10** | **1456** | **1022** | **508.7** |
| **20** | **2829** | **1137** | **595.3** |
| **30** | **3789** | **1097** | **599.86** |
| **40** | **5985** | **1365** | **639.87** |
| **50** | **6215** | **1287** | **640.28** |

2. all use msa\*, very poor performance, alpha, beta choice

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Total search time | move-step | Mean Length of the path | Fail rate |
| 10 | **719** | **718** | **412.2** |  |
| 20 | **734** | **718** | **432** |  |
| 30 | **801** | **718** | **417.5** |  |
| 40 | **882** | **718** | **437** |  |
| 50 | **974** | **718** | **437** |  |

3, mix a\* and msa\*, use a\* if you can report under t=5s, otherwise, switch to msa\*.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Total travel time | move-step | Mean Length of the path |
| 10 | **1872** | **1284** | **665.9** |
| 20 | **1021** | **679** | **448.25** |
| 30 | **1276** | **679** | **443.96** |
| 40 | **1592** | **719** | **456.35** |
| 50 | **1965** | **771** | **487.3** |