

# Assignment 1 Report

FIT5047 Intelligence System

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## 1. Algorithms

### 1.1 A/A\*

My heuristic function for algorithm A is calculate the lowest-cost path regardless the Mountainous unit, which is to move diagonally as much as possible, and then move normally.

For a map with the start  $S(x_s, x_y)$  and the Goal  $G(x_g, x_g)$ , the heuristic function is:

$$h(n) = \min(ver, hoz) + 2abs(ver - hoz)$$
$$ver = abs(x_s - x_g)$$
$$hoz = abs(y_s - y_g)$$

This heuristic function will guarantee that the path is to move diagonally as much as possible, and then move normally.

For a Map like this:

S	X	R	R
R	R	X	R
R	X	X	X
R	R	G	X

*$h(s) = 4$ , whose path is S-LD-LD-D.*

In this case, heuristic function for algorithm A is always on of the least-costing movements, so it is always admissible. Therefore, this algorithm is always A\* instead of A.

## 1.2 Algorithms Performance

In this part four algorithms are compared with each other by the path they found, by the cost the path need and by if the path is optimal. In the tests, four algorithms performance are rarely different in small maps.

### 1.2.1 Test I

For a Map like this with the size of 4:

S	X	R	R
R	R	R	R
R	X	X	R
R	R	G	R

Results calculated with four algorithms:

	Path	Cost	Optimal Path?
BFS	S-D-D-D-R-R-G	10	Y
DFS	S-D-R-R-R-D-D-L-G	14	N
UCS	S-D-D-D-R-R-G	10	Y
A/A*	S-D-D-D-R-R-G	10	Y

### 1.2.2 Test II

For a Map like this with the size of 8:

S	X	R	R	R	R	X	R
R	R	R	R	X	R	R	X
R	X	X	R	R	R	X	X
R	R	R	X	R	R	X	R
R	X	R	R	R	R	X	G
R	R	R	X	R	R	R	R
X	R	X	X	X	X	R	R
X	X	X	R	R	R	R	R

Results calculated with four algorithms:

	Path	Cost	Optimal Path?
BFS	S-D-R-R-R-D-R-DR-D-D-R-R-U-G	23	N
DFS	S-D-R-R-R-D-R-R-D-D-D-R-R-U-G	26	N
UCS	S-D-R-R-R-D-R-DR-DL-DR-R-R-U-G	21	Y
A/A*	S-D-R-R-R-D-R-DR-D-D-R-R-U-G	23	N

## 2. Test

### 2.1 Test I

Input:

```
A
4
6
RSRXGR
RXRXRR
RRRXRX
RRRRXR
RXRXRR
RRRRRR
```

Output:

```
S-L-D-D-DR-R-D-D-R-R-UR-U-U-U-UL-G 25
S 0 6 6
OPEN S-R S-L
CLOSED S
S-R 2 4 6
OPEN S-R-D
CLOSED S S-R
S-R-D 4 3 7
OPEN
CLOSED S S-R S-R-D
S-L 2 8 10
OPEN S-L-D
CLOSED S S-R S-R-D S-L
```

## 2.2 Test II

Input:

```
B
3
5
SRRXG
RXRXR
RRRXR
XRXRR
RRRRX
```

Output:

```
S-D-D-R-D-D-R-R-U-R-U-U-U-G 24
S 0 0 0
OPEN S-R S-D
CLOSED S
S-R 1 0 1
OPEN S-R-R
CLOSED S S-R
S-D 1 0 1
OPEN S-D-D
CLOSED S S-R S-D
```

### 2.3 Test III

Input:

D  
4  
4  
XRGR  
SXRR  
RRXR  
RRRX

Output:

NO PATH.

## 2.4 Test IV

Input:

```
U
5
6
SRRRRR
RRRXXR
RXRRRR
RRXRXR
XRRRRR
GRRRXR
```

Output:

```
S-D-D-D-R-D-D-L-G 14
S 0 10 10
OPEN S-R S-DR S-D
CLOSED S
S-DR 1 7 8
OPEN S-DR-R S-DR-L S-DR-U S-DR-UR
CLOSED S S-DR
S-R 2 9 11
OPEN S-R-R S-R-DR S-R-D S-R-DL
CLOSED S S-DR S-R
S-D 2 8 10
OPEN S-D-R S-D-D S-D-UR
CLOSED S S-DR S-R S-D
S-DR-UR 2 8 10
OPEN S-DR-UR-R S-DR-UR-D S-DR-UR-L
CLOSED S S-DR S-R S-D S-DR-UR
```