# CS 4341: A1 Output

# Map 1

TAPETRI-MACBOOK:CS4341 timpetri$ python astar.py map1.txt 0

World loaded:

2 9 3 4 3 4 5 4 5 7 2 7 1 5 6 8 9 5 8 2

8 1 6 1 2 7 4 5 4 8 3 2 3 3 5 8 7 1 7 9

8 2 3 9 3 9 5 6 9 4 9 6 7 4 9 9 4 4 7 1

5 6 1 2 9 9 1 2 7 6 7 1 3 8 8 2 4 3 6 4

6 5 G 3 9 5 8 2 9 9 9 1 1 5 3 1 1 6 7 5

9 5 5 7 1 7 6 7 9 8 4 2 2 3 2 3 1 3 5 9

3 5 5 8 4 1 6 4 7 8 9 9 3 6 4 7 1 2 9 7

4 1 S 3 3 5 1 5 5 4 3 5 5 4 1 2 2 4 5 5

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

9 1 7 6 3 7 5 1 1 3 4 2 1 9 2 8 4 1 4 5

9 4 7 7 5 7 9 3 3 9 4 7 3 6 5 7 5 9 2 4

5 6 6 5 8 8 3 6 3 8 5 7 6 5 2 2 9 5 6 2

8 3 5 2 7 4 4 7 7 4 4 9 5 8 8 4 5 4 9 5

5 8 4 4 7 8 7 2 7 5 4 6 1 6 3 4 7 6 9 6

2 3 9 4 7 9 8 8 1 8 3 5 7 4 1 8 6 6 6 8

3 3 3 9 6 8 7 4 6 7 3 1 5 5 1 5 1 1 1 9

1 2 4 2 7 8 2 8 4 9 8 2 4 5 7 1 7 8 7 6

2 5 3 1 8 6 2 8 5 1 5 5 1 9 9 5 1 6 9 5

7 4 6 5 1 8 1 7 5 6 8 5 2 7 5 9 1 2 3 9

6 1 2 9 5 1 2 9 3 4 6 5 1 4 7 5 5 8 1 3

Found S: y=7, x=2

Found G: y=4, x=2

Heuristic 1

Score: 91

Number of actions: 3

Number of nodes expanded: 43

List of actions: ['bash', 'forward', 'forward']

Time elapsed: 0.072215

Heuristic 2

Score: 91

Number of actions: 3

Number of nodes expanded: 34

List of actions: ['bash', 'forward', 'forward']

Time elapsed: 0.087936

Heuristic 3

Score: 91

Number of actions: 3

Number of nodes expanded: 20

List of actions: ['forward', 'bash', 'forward']

Time elapsed: 0.051307

Heuristic 4

Score: 91

Number of actions: 3

Number of nodes expanded: 12

List of actions: ['forward', 'bash', 'forward']

Time elapsed: 0.020663

Heuristic 5

Score: 91

Number of actions: 3

Number of nodes expanded: 8

List of actions: ['forward', 'bash', 'forward']

Time elapsed: 0.01321

Heuristic 6

Score: 91

Number of actions: 3

Number of nodes expanded: 2

List of actions: ['bash', 'forward', 'forward']

Time elapsed: 0.003663

All scores: [91, 91, 91, 91, 91, 91]

# Map 2

TAPETRI-MACBOOK:CS4341 timpetri$ python astar.py map2.txt 0

World loaded:

9 7 3 1 9 9 2 4 6 2 9 8 9 4 2

9 9 4 1 5 6 2 1 7 3 4 9 5 9 1

1 3 7 2 1 6 1 5 9 1 2 1 2 1 5

4 5 3 4 8 6 1 2 6 7 2 7 8 1 9

3 7 6 1 4 2 9 3 7 6 5 1 6 9 5

6 5 5 7 5 4 6 8 7 8 4 7 8 8 5

9 6 7 2 7 7 7 1 6 5 5 G 4 1 8

8 1 1 4 8 6 1 3 6 2 9 2 9 9 1

3 4 6 2 5 3 1 3 1 6 1 2 5 9 3

7 1 3 9 2 1 5 2 9 1 7 5 5 9 6

2 1 5 5 5 8 1 8 4 1 1 3 5 5 2

6 2 3 S 4 3 8 6 7 9 4 7 3 3 8

1 4 6 3 3 3 9 1 1 5 2 5 6 5 5

3 2 7 4 9 1 6 6 2 9 7 9 3 1 4

3 8 5 4 6 5 9 1 1 2 8 8 5 9 1

Found S: y=11, x=3

Found G: y=6, x=11

Heuristic 1

Score: 69

Number of actions: 17

Number of nodes expanded: 1197

List of actions: ['turn right', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'forward']

Time elapsed: 1.65484

Heuristic 2

Score: 69

Number of actions: 17

Number of nodes expanded: 976

List of actions: ['turn right', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'forward']

Time elapsed: 1.307376

Heuristic 3

Score: 69

Number of actions: 17

Number of nodes expanded: 672

List of actions: ['turn right', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'forward']

Time elapsed: 0.871222

Heuristic 4

Score: 69

Number of actions: 17

Number of nodes expanded: 503

List of actions: ['turn right', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'forward']

Time elapsed: 0.663749

Heuristic 5

Score: 69

Number of actions: 17

Number of nodes expanded: 379

List of actions: ['turn right', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'forward']

Time elapsed: 0.469706

Heuristic 6

Score: 68

Number of actions: 17

Number of nodes expanded: 12

List of actions: ['turn right', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward']

Time elapsed: 0.012762

All scores: [69, 69, 69, 69, 69, 68]

# Map 3

TAPETRI-MACBOOK:CS4341 timpetri$ python astar.py map3.txt 0

World loaded:

9 7 7 2 7 2 8 7 3 8 9 9 4 8 1 5 9 2

5 9 9 3 G 4 6 5 8 2 4 6 2 4 1 8 1 4

4 9 5 4 3 2 9 8 9 7 3 9 5 7 9 1 7 7

4 3 3 1 7 1 4 2 6 4 6 5 5 6 6 7 6 4

8 8 2 1 8 4 5 8 3 9 7 8 7 3 4 6 1 2

2 3 4 9 8 6 9 3 6 6 5 8 6 9 9 4 4 2

9 6 3 9 7 8 5 9 1 9 5 5 2 9 1 9 4 5

1 6 7 5 9 1 7 4 1 6 8 1 5 2 1 6 5 2

5 7 6 8 9 8 5 1 7 6 2 1 7 1 6 1 8 3

8 7 7 5 7 8 2 6 3 2 1 6 7 2 2 2 8 5

3 4 5 2 5 8 7 5 2 5 5 8 9 5 4 7 1 5

9 8 9 1 7 1 3 8 3 2 3 6 3 5 4 2 2 1

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

3 2 3 4 1 5 6 5 9 2 4 8 8 2 9 3 4 9

4 1 8 8 8 7 5 7 6 6 4 9 2 9 1 4 2 5

5 8 1 9 4 3 8 4 4 1 1 7 9 2 4 3 4 6

5 4 8 6 3 2 6 8 2 7 6 9 4 9 4 8 3 6

7 S 2 5 8 3 8 2 2 5 9 9 8 1 8 7 1 1

Found S: y=17, x=1

Found G: y=1, x=4

Heuristic 1

Score: 41

Number of actions: 23

Number of nodes expanded: 2125

List of actions: ['forward', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'turn left', 'bash', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward']

Time elapsed: 3.979137

Heuristic 2

Score: 41

Number of actions: 23

Number of nodes expanded: 1798

List of actions: ['forward', 'bash', 'forward', 'forward', 'turn right', 'bash', 'forward', 'turn left', 'forward', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward']

Time elapsed: 3.166815

Heuristic 3

Score: 41

Number of actions: 23

Number of nodes expanded: 1567

List of actions: ['forward', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'turn left', 'bash', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward']

Time elapsed: 2.882978

Heuristic 4

Score: 41

Number of actions: 23

Number of nodes expanded: 1355

List of actions: ['forward', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'turn left', 'bash', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward']

Time elapsed: 2.35082

Heuristic 5

Score: 41

Number of actions: 23

Number of nodes expanded: 1229

List of actions: ['forward', 'bash', 'forward', 'forward', 'turn right', 'bash', 'forward', 'turn left', 'forward', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward']

Time elapsed: 2.151143

Heuristic 6

Score: 41

Number of actions: 23

Number of nodes expanded: 216

List of actions: ['forward', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'turn left', 'bash', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward']

Time elapsed: 0.362283

All scores: [41, 41, 41, 41, 41, 41]

# Map 4

TAPETRI-MACBOOK:CS4341 timpetri$ python astar.py map4.txt 0

World loaded:

9 2 7 6 7 9 5 1 9 8 7 2 7 2 8 9 4 3 5 4

8 6 6 9 2 6 1 2 4 8 5 8 4 9 3 6 8 8 1 7

1 3 6 4 5 3 5 4 2 9 3 4 6 7 5 7 9 3 8 7

2 6 7 9 5 7 4 6 3 G 5 7 1 1 2 6 9 2 8 8

9 4 1 9 5 4 8 2 3 2 3 6 1 2 7 7 3 6 5 3

3 7 2 4 7 5 7 2 7 5 7 5 3 7 3 5 1 6 9 3

4 8 9 9 3 2 1 7 9 8 3 6 4 1 3 6 5 7 3 3

4 6 9 5 3 1 9 2 3 3 4 6 5 8 7 9 5 9 6 1

3 6 7 8 2 5 1 1 8 9 9 1 2 8 1 7 6 6 3 2

4 1 4 4 2 2 1 6 9 8 7 4 1 4 6 4 6 2 6 1

2 9 5 5 9 7 4 6 3 2 2 5 5 3 7 7 4 6 9 3

2 3 9 5 9 8 2 8 4 9 6 8 5 3 9 9 7 8 3 5

4 9 1 7 2 1 8 8 9 7 1 6 9 1 2 3 5 9 2 4

1 1 4 4 5 8 3 5 2 9 1 4 2 1 2 6 5 2 7 6

4 9 1 3 3 5 9 7 5 6 7 1 8 2 2 3 1 6 8 6

9 6 8 2 9 4 2 4 7 4 2 7 4 8 4 4 7 4 9 1

4 7 3 4 2 8 9 6 3 9 5 6 5 4 2 9 7 2 5 7

6 7 5 7 3 6 7 8 7 6 6 1 3 9 8 6 7 3 S 2

8 1 1 1 1 9 7 5 1 8 2 4 8 6 4 9 7 4 2 2

3 5 5 4 1 7 5 2 3 3 6 4 3 7 5 8 9 3 4 8

Found S: y=17, x=18

Found G: y=3, x=9

Heuristic 1

Score: 33

Number of actions: 28

Number of nodes expanded: 3112

List of actions: ['turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'turn left', 'forward', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'forward', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'bash', 'forward', 'forward']

Time elapsed: 6.980056

Heuristic 2

Score: 33

Number of actions: 28

Number of nodes expanded: 2779

List of actions: ['turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'turn left', 'forward', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'forward', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'forward', 'bash', 'forward', 'forward']

Time elapsed: 6.441738

Heuristic 3

Score: 33

Number of actions: 30

Number of nodes expanded: 2366

List of actions: ['turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'turn left', 'forward', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'bash', 'forward', 'demolish', 'forward', 'bash', 'forward', 'bash', 'forward', 'turn left', 'forward', 'bash', 'forward', 'forward', 'turn right', 'forward']

Time elapsed: 5.486402

Heuristic 4

Score: 33

Number of actions: 30

Number of nodes expanded: 2204

List of actions: ['turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'turn left', 'forward', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'bash', 'forward', 'turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'forward']

Time elapsed: 5.19022

Heuristic 5

Score: 33

Number of actions: 31

Number of nodes expanded: 2089

List of actions: ['turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'turn left', 'forward', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'forward', 'bash', 'forward', 'turn left', 'forward', 'turn right', 'forward', 'bash', 'forward', 'bash', 'forward', 'turn left', 'bash', 'forward', 'forward', 'turn right', 'forward']

Time elapsed: 4.747938

Heuristic 6

Score: 30

Number of actions: 30

Number of nodes expanded: 28

List of actions: ['turn left', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'turn left', 'forward', 'bash', 'forward', 'forward', 'forward', 'bash', 'forward', 'turn right', 'forward', 'bash', 'forward', 'turn left', 'forward', 'turn right', 'demolish', 'forward', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward']

Time elapsed: 0.048719

All scores: [33, 33, 33, 33, 33, 30]

# Map 5

TAPETRI-MACBOOK:CS4341 timpetri$ python astar.py map5.txt 0

World loaded:

8 7 9 6 8 5 1 2 3 1 8 5 4 2 8 7 2 7 2 4

4 7 8 4 6 8 7 6 2 8 9 7 2 2 8 2 4 8 2 3

7 8 6 9 5 5 8 3 6 2 1 3 9 3 4 8 6 1 1 3

4 9 7 9 6 4 2 5 6 9 2 5 4 7 8 8 4 4 7 6

1 G 6 6 7 6 3 1 8 5 3 8 5 3 7 5 2 2 1 3

7 5 9 6 1 4 8 8 1 7 4 6 6 5 2 6 9 2 9 4

7 7 5 9 7 9 8 8 9 2 6 7 5 9 4 5 3 6 2 5

2 6 3 3 9 3 7 1 9 1 5 7 6 7 9 2 5 3 3 9

6 1 4 6 4 9 6 4 6 4 3 7 4 7 3 6 5 1 6 4

6 6 9 9 6 6 6 9 2 8 8 4 5 8 1 4 9 1 3 6

4 7 6 3 2 7 7 5 4 3 6 5 5 4 6 5 2 1 2 2

8 2 4 3 2 8 3 5 8 2 4 5 2 6 7 3 3 6 5 6

3 3 6 5 8 6 5 6 5 2 1 1 S 1 6 7 6 8 6 8

3 1 5 3 3 5 4 4 9 7 4 4 2 1 7 3 6 3 2 9

3 3 9 1 5 7 7 8 7 8 2 4 8 7 6 8 2 5 5 1

6 6 6 5 8 8 5 5 5 3 8 9 4 2 6 6 7 5 9 9

7 4 3 7 6 7 4 3 2 3 8 2 1 9 9 7 8 9 8 7

4 2 5 2 8 3 1 2 8 3 3 1 9 2 7 3 3 6 4 9

4 7 6 8 5 9 7 6 8 3 6 7 9 4 1 5 5 7 9 4

1 3 9 9 2 4 3 2 2 6 8 3 5 8 7 1 5 8 3 3

Found S: y=12, x=12

Found G: y=4, x=1

Heuristic 1

Score: 46

Number of actions: 24

Number of nodes expanded: 4220

List of actions: ['turn left', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'demolish', 'forward', 'turn right', 'forward', 'bash', 'forward']

Time elapsed: 9.749566

Heuristic 2

Score: 46

Number of actions: 24

Number of nodes expanded: 4033

List of actions: ['turn left', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'demolish', 'forward', 'turn right', 'forward', 'bash', 'forward']

Time elapsed: 9.865652

Heuristic 3

Score: 46

Number of actions: 24

Number of nodes expanded: 3109

List of actions: ['turn left', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'demolish', 'forward', 'turn right', 'forward', 'bash', 'forward']

Time elapsed: 7.079849

Heuristic 4

Score: 46

Number of actions: 24

Number of nodes expanded: 2627

List of actions: ['turn left', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'demolish', 'forward', 'turn right', 'forward', 'bash', 'forward']

Time elapsed: 5.836649

Heuristic 5

Score: 46

Number of actions: 24

Number of nodes expanded: 2358

List of actions: ['turn left', 'forward', 'forward', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'forward', 'demolish', 'forward', 'turn right', 'forward', 'bash', 'forward']

Time elapsed: 5.152373

Heuristic 6

Score: 42

Number of actions: 23

Number of nodes expanded: 47

List of actions: ['turn left', 'bash', 'forward', 'forward', 'turn right', 'forward', 'forward', 'bash', 'forward', 'forward', 'turn left', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'bash', 'forward', 'turn right', 'bash', 'forward', 'forward']

Time elapsed: 0.079494

All scores: [46, 46, 46, 46, 46, 42]