Dla cofania o 100 ruchów:

Średnia z 30 losowych stanów gry, używając heurystyki

int heuristic(vector<vector<int> > gamestate)

{

int grade = 0;

for(int i = 0; i<4; i++)

{

for(int j=0; j<4; j++)

{

if(gamestate[i][j]==0) continue;

grade = grade + (abs(i-(gamestate[i][j]-1)/4)) + (abs(j-(gamestate[i][j]-1)%4));

}

}

return grade;

}

I zwiększając g(n) na każdym poziomie o 1

5 3 8 7

9 1 6 12

10 2 15 11

13 14 4 0

34 moves: L U R D L U R U U L L D D L U U R D R R U L D D D R U U L U R D D D

156506 visited states

10 9 5 7

3 1 4 2

14 12 8 15

6 13 11 0

36 moves: U L L L D R U U L U R R D R U L D L D L U U R D D L U U R R D R D L D R

833 visited states

1 2 3 4

10 5 11 6

14 9 13 8

7 12 15 0

28 moves: L U U L D D R U L L D R U L U R R R D L L L U R R D D R

4186 visited states

2 5 6 8

1 10 4 12

9 7 3 15

13 14 11 0

24 moves: U U U L D D R U U L D R D L L U U L D R R D D R

2103 visited states

1 14 4 10

12 2 6 3

9 5 15 7

13 8 11 0

42 moves: L U U U R D L L U R D D D L L U R U L D D R U U U R R D D L D R U L L U R R D L D R

432216 visited states

1 2 3 4

14 5 7 10

9 6 11 8

13 15 12 0

20 moves: L L L U U R R R D L U L D L D R U R R D

540 visited states

2 1 3 8

6 7 4 11

5 9 10 15

13 12 14 0

34 moves: L L U L U U R R D L L D R R D R U L L D R R U U U L L D L D R R R D

377381 visited states

1 7 3 4

14 11 15 13

10 5 8 2

9 6 12 0

44 moves: U U L D R D L U R U L L D L U R D R R U L L D D R U U R U L L D D L D R U R U U R D D D

2733411 visited states

1 2 3 4

5 10 7 12

9 11 8 15

13 6 14 0

18 moves: U U L L D D R R U L U L D R U R D D

1230 visited states

3 9 4 8

1 7 6 11

5 14 2 12

10 13 15 0

30 moves: U U U L D L U L D D D R U R U U L L D R D L U U R D R D R D

9854 visited states

9 5 2 3

10 6 8 7

12 1 4 15

13 14 11 0

26 moves: U L U L D L U U R D R R D L L L U U R R R D D L D R

433 visited states

3 6 7 4

2 5 8 14

1 10 11 12

9 13 15 0

26 moves: U U L D R D L U L U U L D D R R U U L L D D D R R R

2661 visited states

2 3 4 11

1 5 12 7

10 14 8 15

9 6 13 0

26 moves: U L L D R U U R U L D R D L U U L L D R D L D R R R

622 visited states

1 7 2 4

6 10 3 8

5 13 12 15

9 14 11 0

16 moves: U L D L U U U R D L L D D R R R

80 visited states

6 3 4 12

5 1 8 9

13 7 2 15

14 11 10 0

28 moves: U U U L L D D R R U L L D R D L L U U U R D L D R R D R

704 visited states

1 3 8 7

2 6 11 4

10 15 14 12

9 5 13 0

32 moves: U L L U L D R D R U R D L U U U R D L U L D D L U R D L D R R R

35516 visited states

5 1 7 2

3 8 4 12

13 14 9 15

11 6 10 0

32 moves: U U L L L D R D L U U U R R R D L L U R D L D R D L L U R R D R

3247 visited states

9 1 8 2

6 3 4 12

10 5 7 15

11 13 14 0

28 moves: U U L U R D L L D L D R U L U U R R D D L L U R D D R R

695 visited states

6 1 4 8

2 12 15 3

5 7 11 9

13 10 14 0

30 moves: L U R U L L D R R U L D D R U U U L D L L U R D L D R D R R

4353 visited states

1 3 2 11

7 8 15 9

6 5 4 12

13 10 14 0

34 moves: U L U R D L U L U R D R U L D L L D R R R U U L D L L D R D R U R D

24084 visited states

6 10 3 4

1 2 7 8

5 13 9 12

14 11 15 0

28 moves: L L L U U R U L D D R R D L U L D R U U U L D D D R R R

21766 visited states

9 7 4 8

5 2 3 6

1 10 11 12

13 14 15 0

32 moves: U L U R U L L D L U R R D D L U L D R U U R D L U L D D R R R D

148389 visited states

6 10 4 3

7 1 8 11

2 5 12 15

13 14 9 0

34 moves: U L D R U U L U L D L D R R R U L U R D D L U L L U R D L D R R R D

30439 visited states

5 1 4 7

10 11 8 12

3 2 13 15

9 14 6 0

32 moves: U U L L D R D L U L U U R D D R U L D L D R R R U U U L D R D D

9147 visited states

5 4 8 3

1 12 6 15

14 2 9 11

13 10 7 0

42 moves: U U L L L D R R U R U L L D L D R R D L U U L U R D R R U L D D D L U R D R U L D R

1323192 visited states

5 1 3 4

9 7 6 8

10 11 2 12

13 14 15 0

20 moves: U U L D L U R R D L L L U U R D R D R D

1003 visited states

1 8 7 2

13 14 3 6

5 11 10 4

9 15 12 0

38 moves: L U L U L D R U R U R D D L U U L D R U R D L U L D R D D L U L D R U R R D

137216 visited states

1 4 12 5

9 3 11 8

13 2 7 15

10 6 14 0

30 moves: U L U U R D L U L D D R R U U L L D R D L D L U U R D D R R

1187 visited states

1 6 2 4

9 5 12 3

13 10 11 7

14 8 15 0

24 moves: L U U R D L D L L U U R U R D D D R U L U R D D

1352 visited states

1 2 3 4

5 10 7 8

9 11 6 12

13 14 15 0

10 moves: U U L D L U R R D D

94 visited states

Average moves: 29

Average visited states: 182148

Dla cofania o 100 ruchów:

Średnia z 50 losowych stanów gry, używając heurystyki

int heuristic(vector<vector<int> > gamestate)

{

int grade = 0;

for(int i = 0; i<4; i++)

{

for(int j=0; j<4; j++)

{

if(gamestate[i][j]==0) continue;

if(gamestate[i][j] != i\*4+j+1) grade++;

}

}

return grade;

}

I zwiększając g(n) na każdym poziomie o 1

1 6 2 4

5 9 10 7

13 3 8 12

14 15 11 0

18 moves: U L L U R D D L L U R U U R D R D D

1366 visited states

6 3 4 8

2 9 7 12

1 5 10 15

13 14 11 0

18 moves: U U U L L L D D R U U L D D R R D R

643 visited states

5 1 3 11

2 4 12 8

9 7 6 15

13 10 14 0

26 moves: U U L L L U R R D R U L L D D R U R D L U L D D R R

141692 visited states

1 2 6 4

5 9 3 8

13 10 7 11

14 15 12 0

20 moves: L L L U U U R R D D L U U L D D R R R D

8519 visited states

1 2 4 8

5 6 3 11

9 10 7 12

13 14 15 0

8 moves: U U U L D D R D

26 visited states

1 3 7 4

6 2 8 11

5 9 15 12

13 10 14 0

14 moves: U U L U L D L D R D R U R D

103 visited states

2 5 3 4

9 11 7 8

6 1 10 12

13 14 15 0

18 moves: U U L L D L U R U L D R D R U R D D

2398 visited states

6 7 4 8

2 3 1 12

5 10 11 15

9 13 14 0

20 moves: U U U L L D R U L D L U R D L D D R R R

1084 visited states

5 1 2 3

10 9 8 6

15 14 4 12

11 13 7 0

30 moves: U L L L D R U R U R D L D L U L U R R D L L U U R R R D D D

772529 visited states

1 7 3 15

5 2 6 11

9 10 4 8

13 14 12 0

22 moves: U U U L L D R R D L U R D D L U U U R D D D

20654 visited states

2 4 7 3

1 10 6 8

5 9 12 15

13 14 11 0

20 moves: U U U L L L D D R U R R U L D R D L D R

3503 visited states

10 1 2 4

9 11 3 8

5 6 14 12

13 7 15 0

24 moves: L U L U L U R R D D L U L D R D R U L U R D D R

66477 visited states

2 7 6 4

10 11 3 8

1 12 15 14

5 9 13 0

26 moves: U L L U L D D R R R U L L U U R D L U L D D D R R R

72942 visited states

5 7 1 3

6 12 11 4

9 2 14 8

13 10 15 0

24 moves: L U U L D R U L U R D L L U R R R D D L L D R R

35335 visited states

5 2 8 7

6 1 11 4

9 3 12 15

13 10 14 0

24 moves: U L U U R D L U L D D R U L L U R R D D L D R R

35792 visited states

1 2 3 4

5 6 7 8

14 15 13 11

9 10 12 0

14 moves: L U L D R U L L D R U R R D

366 visited states

5 6 3 4

1 2 7 8

10 15 11 12

9 13 14 0

22 moves: U L L U L U R D D L U U R D L D D R R U R D

16511 visited states

1 5 4 7

6 2 3 12

9 8 10 15

13 14 11 0

30 moves: U U U L L D L U R R D R D L L U R D R U L L U L D R D R D R

2154832 visited states

1 2 4 8

5 6 3 12

10 7 15 11

9 13 14 0

16 moves: U L L L D R R R U U U L D D D R

395 visited states

1 3 4 7

5 2 15 8

9 6 10 11

13 14 12 0

16 moves: U U U L L D D R U R D D L U R D

864 visited states

2 3 7 4

1 6 12 15

13 10 8 14

5 9 11 0

24 moves: U U L D L L D R U R D R U U L U L L D D D R R R

24706 visited states

1 3 4 7

5 2 6 8

9 12 15 11

13 10 14 0

18 moves: U U U L L D R R D L L D R R U L D R

2387 visited states

5 1 2 3

7 9 15 4

6 14 8 11

13 12 10 0

24 moves: U L D L U U L D R R U L L U R R R D D D L U R D

21718 visited states

5 1 7 3

10 6 4 8

2 9 15 12

13 11 14 0

22 moves: U U L L L D R D R U L U L U R D R U R D D D

8991 visited states

1 2 8 3

5 7 10 4

11 15 14 12

9 13 6 0

26 moves: U L L L D R R U R D L U L D R U U U R D L L D R D R

192074 visited states

1 6 4 11

5 10 3 2

14 15 13 7

9 8 12 0

28 moves: L U L D R U L L D R U U R R U L D L U R D D R U L D R D

333910 visited states

1 2 3 4

5 6 8 12

13 11 7 15

10 9 14 0

12 moves: U U L D L D L U R D R R

96 visited states

1 2 3 4

5 6 7 8

13 12 11 14

10 9 15 0

18 moves: U L D R U L L D L U R D R R U L D R

4095 visited states

1 2 3 4

5 6 8 12

9 10 11 7

13 14 15 0

8 moves: L U R U L D D R

73 visited states

6 3 7 4

2 1 8 12

5 10 11 15

9 13 14 0

16 moves: U U L U L D L U R D L D D R R R

141 visited states

Average moves: 20

Average visited states: 130807