

Submission	
Submission time	Fri-02-Oct 21:56:54
Raw Score	100.00 / 100.00
Feedback	See the Assessment Guide for information on how to interpret this report.

Assessment Summary

Compilation:

PASSED

Style:

PASSED

Findbugs:

No potential bugs found.

API:

PASSED

Correctness:

42/42 tests passed

Memory:

8/8 tests passed

Timing:

17/17 tests passed

Aggregate score:

100.00% [Correctness: 65%, Memory: 10%, Timing: 25 %, Style: 0%]

Assessment Details

The following files were submitted:

total 20K

-rw-r--r--

1

4.7K

Oct 3 04:57

Board.java

-rw-r--r--

1

5.0K

Oct 3 04:57

Solver.java

-rw-r--r--

1

3.0K

Oct 3 04:57

studentSubmission.zip

* compiling

```
% javac Board.java
```

```
*-----
```

```
=====
```

```
% javac Solver.java
```

```
*-----
```

```
Note: Solver.java uses unchecked or unsafe operations.
```

```
Note: Recompile with -Xlint:unchecked for details.
```

```
=====
```

```
% checkstyle *.java
```

```
*-----
```

```
=====
```

```
% findbugs *.class
```

```
*-----
```

```
=====
```

```
Testing the APIs of your programs.
```

```
*-----
```

```
Board:
```

```
Solver:
```

```
=====
```

```
*****
```

```
*****
```

```
* correctness
```

```
*****
```

```
*****
```

```
Testing methods in Board
```

```
*-----
```

```
Running 22 total tests.
```

Tests 5, 6, 13, and 14 rely upon toString() returning results in prescribed format.

Test 1a: Test hamming() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle07.txt
- * puzzle17.txt
- * puzzle27.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 1b: Test hamming() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 2a: Test manhattan() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle07.txt
- * puzzle17.txt
- * puzzle27.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 2b: Test manhattan() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 3: Test dimension() with random N-by-N boards

- * 2-by-2

- * 3-by-3
- * 4-by-4
- * 5-by-5

==> passed

Test 4a: Test toString() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 4b: Test toString() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 5a: Test neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 5b: Test neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 6a: Test neighbors() of neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 6b: Test neighbors() of neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 7a: Test twin() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 7b: Test twin() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 8a: Test isGoal() on file inputs

- * puzzle00.txt
- * puzzle04.txt
- * puzzle16.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt
- * puzzle3x3-unsolvable1.txt

- * puzzle3x3-00.txt
- * puzzle4x4-00.txt

==> passed

Test 8b: Test isGoal() on N-by-N goal boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 6-by-6
- * 100-by-100

==> passed

Test 9: Check whether two Board objects can be created at the same time

- * random 3-by-3 and 3-by-3 boards
- * random 4-by-4 and 4-by-4 boards
- * random 2-by-2 and 2-by-2 boards
- * random 3-by-3 and 4-by-4 boards
- * random 4-by-4 and 3-by-3 boards

==> passed

Test 10a: Check equals()

- * reflexive
- * symmetric
- * checks that individual entries of array are equal
- * argument is object of type String
- * argument is object of type Object
- * argument is null
- * argument is Board of different dimension

==> passed

Test 10b: Test equals() on M-by-M vs. N-by-N goal boards

- * M = 2, N = 2
- * M = 3, N = 3
- * M = 4, N = 4
- * M = 2, N = 5
- * M = 5, N = 2

==> passed

Test 11: Check that Board is immutable by changing argument array after

construction and making sure Board does not mutate

==> passed

Test 12: Check that Board is immutable by testing whether methods
return the same value, regardless of order in which called

- * puzzle10.txt
- * puzzle20.txt
- * puzzle30.txt
- * 2-by-2
- * 3-by-3
- * 4-by-4

==> passed

Test 13: Call hamming() on a board that is kth-neighbor of a board

- * 0th neighbor of puzzle27.txt
- * 1th neighbor of puzzle27.txt
- * 2th neighbor of puzzle27.txt
- * 13th neighbor of puzzle27.txt
- * 13th neighbor of puzzle00.txt
- * 13th neighbor of puzzle2x2-unsolvable1.txt

==> passed

Test 14: Call manhattan() on a board that is a kth-neighbor of a board

- * 0th neighbor of puzzle27.txt
- * 1th neighbor of puzzle27.txt
- * 2th neighbor of puzzle27.txt
- * 13th neighbor of puzzle27.txt
- * 13th neighbor of puzzle00.txt
- * 13th neighbor of puzzle2x2-unsolvable1.txt

==> passed

Total: 22/22 tests passed!

=====

* correctness (substituting reference Board.java)

Testing methods in Solver

*-----

Running 20 total tests.

Test 1: Call moves() with file inputs

- * puzzle00.txt
- * puzzle01.txt
- * puzzle02.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle05.txt
- * puzzle06.txt
- * puzzle07.txt
- * puzzle08.txt
- * puzzle09.txt
- * puzzle10.txt
- * puzzle11.txt
- * puzzle12.txt
- * puzzle13.txt

==> passed

Test 2: Call solution() with file inputs

- * puzzle00.txt
- * puzzle01.txt
- * puzzle02.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle05.txt
- * puzzle06.txt
- * puzzle07.txt
- * puzzle08.txt
- * puzzle10.txt
- * puzzle15.txt

==> passed

Test 3: Create two Solver objects at the same time

- * puzzle04.txt and puzzle04.txt
- * puzzle00.txt and puzzle04.txt
- * puzzle04.txt and puzzle00.txt

==> passed

Test 4a: Call isSolvable() with file inputs

- * puzzle01.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle17.txt
- * puzzle3x3-unsolvable1.txt

- * puzzle3x3-unsolvable2.txt
- * puzzle4x4-unsolvable.txt

==> passed

Test 4b: Call isSolvable() on random N-by-N puzzles

- * 100 random 2-by-2 boards

==> passed

Test 5: Call moves() on unsolvable puzzles

- * puzzle2x2-unsolvable1.txt
- * puzzle2x2-unsolvable2.txt
- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-unsolvable2.txt
- * puzzle4x4-unsolvable.txt

==> passed

Test 6: Call solution() on unsolvable puzzles

- * puzzle2x2-unsolvable1.txt
- * puzzle2x2-unsolvable2.txt
- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-unsolvable2.txt
- * puzzle4x4-unsolvable.txt

==> passed

Test 7a: Check that Solver is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-05.txt
- * puzzle3x3-10.txt
- * random 2-by-2 solvable boards

==> passed

Test 7b: Check that Solver is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-unsolvable2.txt
- * puzzle4x4-unsolvable.txt
- * random 2-by-2 unsolvable boards

==> passed

Test 8: Call moves() with more file inputs

- * puzzle14.txt
- * puzzle15.txt

- * puzzle16.txt
- * puzzle17.txt
- * puzzle18.txt
- * puzzle19.txt
- * puzzle20.txt
- * puzzle21.txt
- * puzzle22.txt
- * puzzle23.txt
- * puzzle24.txt
- * puzzle25.txt
- * puzzle26.txt
- * puzzle27.txt
- * puzzle28.txt
- * puzzle29.txt
- * puzzle30.txt
- * puzzle31.txt

==> passed

Test 9: Check whether equals() method in Board is called
with an argument of the wrong type

- * puzzle00.txt
- * puzzle05.txt
- * puzzle10.txt
- * puzzle15.txt

==> passed

Test 10: Check that constructor throws exception if board is null
==> passed

Test 11: Check for fragile dependence on toString()

- * puzzle00.txt
- * puzzle04.txt
- * puzzle08.txt
- * puzzle12.txt

==> passed

Test 12a: Call moves() with 2-by-2 file inputs

- * puzzle2x2-00.txt
- * puzzle2x2-01.txt
- * puzzle2x2-02.txt
- * puzzle2x2-03.txt
- * puzzle2x2-04.txt
- * puzzle2x2-05.txt
- * puzzle2x2-06.txt

==> passed

Test 12b: Call solution() with 2-by-2 file inputs

- * puzzle2x2-00.txt
- * puzzle2x2-01.txt
- * puzzle2x2-02.txt
- * puzzle2x2-03.txt
- * puzzle2x2-04.txt
- * puzzle2x2-05.txt
- * puzzle2x2-06.txt

==> passed

Test 13a: Call moves() with 3-by-3 file inputs

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-02.txt
- * puzzle3x3-03.txt
- * puzzle3x3-04.txt
- * puzzle3x3-05.txt
- * puzzle3x3-06.txt
- * puzzle3x3-07.txt
- * puzzle3x3-08.txt
- * puzzle3x3-09.txt
- * puzzle3x3-10.txt
- * puzzle3x3-11.txt
- * puzzle3x3-12.txt
- * puzzle3x3-13.txt
- * puzzle3x3-14.txt
- * puzzle3x3-15.txt
- * puzzle3x3-16.txt
- * puzzle3x3-17.txt
- * puzzle3x3-18.txt
- * puzzle3x3-19.txt
- * puzzle3x3-20.txt
- * puzzle3x3-21.txt
- * puzzle3x3-22.txt
- * puzzle3x3-23.txt
- * puzzle3x3-24.txt
- * puzzle3x3-25.txt
- * puzzle3x3-26.txt
- * puzzle3x3-27.txt
- * puzzle3x3-28.txt
- * puzzle3x3-29.txt
- * puzzle3x3-30.txt

==> passed

Test 13b: Call solution() with 3-by-3 file inputs

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-02.txt
- * puzzle3x3-03.txt
- * puzzle3x3-04.txt
- * puzzle3x3-05.txt
- * puzzle3x3-06.txt
- * puzzle3x3-07.txt
- * puzzle3x3-08.txt
- * puzzle3x3-09.txt
- * puzzle3x3-10.txt
- * puzzle3x3-11.txt
- * puzzle3x3-12.txt
- * puzzle3x3-13.txt
- * puzzle3x3-14.txt
- * puzzle3x3-15.txt
- * puzzle3x3-16.txt
- * puzzle3x3-17.txt
- * puzzle3x3-18.txt
- * puzzle3x3-19.txt
- * puzzle3x3-20.txt
- * puzzle3x3-21.txt
- * puzzle3x3-22.txt
- * puzzle3x3-23.txt
- * puzzle3x3-24.txt
- * puzzle3x3-25.txt
- * puzzle3x3-26.txt
- * puzzle3x3-27.txt
- * puzzle3x3-28.txt
- * puzzle3x3-29.txt
- * puzzle3x3-30.txt

==> passed

Test 14a: Call moves() with 4-by-4 file inputs

- * puzzle4x4-00.txt
- * puzzle4x4-01.txt
- * puzzle4x4-02.txt
- * puzzle4x4-03.txt
- * puzzle4x4-04.txt
- * puzzle4x4-05.txt
- * puzzle4x4-06.txt

- * puzzle4x4-07.txt
- * puzzle4x4-08.txt
- * puzzle4x4-09.txt
- * puzzle4x4-10.txt
- * puzzle4x4-11.txt
- * puzzle4x4-12.txt
- * puzzle4x4-13.txt
- * puzzle4x4-14.txt
- * puzzle4x4-15.txt
- * puzzle4x4-16.txt
- * puzzle4x4-17.txt
- * puzzle4x4-18.txt
- * puzzle4x4-19.txt
- * puzzle4x4-20.txt
- * puzzle4x4-21.txt
- * puzzle4x4-22.txt
- * puzzle4x4-23.txt
- * puzzle4x4-24.txt
- * puzzle4x4-25.txt
- * puzzle4x4-26.txt
- * puzzle4x4-27.txt
- * puzzle4x4-28.txt
- * puzzle4x4-29.txt
- * puzzle4x4-30.txt

==> passed

Test 14b: Call solution() with 4-by-4 file inputs

- * puzzle4x4-00.txt
- * puzzle4x4-01.txt
- * puzzle4x4-02.txt
- * puzzle4x4-03.txt
- * puzzle4x4-04.txt
- * puzzle4x4-05.txt
- * puzzle4x4-06.txt
- * puzzle4x4-07.txt
- * puzzle4x4-08.txt
- * puzzle4x4-09.txt
- * puzzle4x4-10.txt
- * puzzle4x4-11.txt
- * puzzle4x4-12.txt
- * puzzle4x4-13.txt
- * puzzle4x4-14.txt
- * puzzle4x4-15.txt
- * puzzle4x4-16.txt

- * puzzle4x4-17.txt
- * puzzle4x4-18.txt
- * puzzle4x4-19.txt
- * puzzle4x4-20.txt
- * puzzle4x4-21.txt
- * puzzle4x4-22.txt
- * puzzle4x4-23.txt
- * puzzle4x4-24.txt
- * puzzle4x4-25.txt
- * puzzle4x4-26.txt
- * puzzle4x4-27.txt
- * puzzle4x4-28.txt
- * puzzle4x4-29.txt
- * puzzle4x4-30.txt

==> passed

Test 15: Call moves() with random solvable N-by-N boards

- * 100 random 2-by-2 boards
- * 200 random 3-by-3 boards that are <= 20 moves from goal
- * 200 random 4-by-4 boards that are <= 20 moves from goal
- * 200 random 5-by-5 boards that are <= 20 moves from goal

==> passed

Total: 20/20 tests passed!

=====

* memory

Computing memory of Board

*-----

Running 8 total tests.

Memory usage of an N-by-N board

	N	student (bytes)	reference (bytes)

=> passed	4	256	240
=> passed	8	576	560

```

=> passed      12          1024          1008
=> passed      16          1600          1584
=> passed      20          2304          2288
=> passed      36          6400          6384
=> passed      72         23104         23088
=> passed     120         61504         61488
==> 8/8 tests passed

```

Total: 8/8 tests passed!

```

Student   memory = 4.00 N^2 + 32.00 N + 64.00   (R^2 = 1.000)
Reference memory = 4.00 N^2 + 32.00 N + 48.00   (R^2 = 1.000)

```

```

=====

```

```

*****
*****
*   timing
*****
*****

```

Timing Solver

```

*-----

```

Running 17 total tests.

Timing tests use your implementation of Board.java and Solver.java.
Maximum time allowed per puzzle is 10 seconds.

	filename	N	seconds	insert()	delMi
n()	max PQ size				

=> passed	puzzle20.txt	3	0.03	1069	644
425					
=> passed	puzzle21.txt	3	0.02	1951	1156
795					
=> passed	puzzle22.txt	3	0.04	3198	1892
1306					
=> passed	puzzle23.txt	3	0.04	4344	2594
1750					
=> passed	puzzle24.txt	3	0.02	2316	1404
912					

=> passed	puzzle25.txt	3	0.08	7533	4512
3021					
=> passed	puzzle26.txt	3	0.05	5150	3124
2026					
=> passed	puzzle27.txt	3	0.06	5972	3644
2328					
=> passed	puzzle28.txt	3	0.18	15669	9540
6129					
=> passed	puzzle29.txt	3	0.12	10847	6666
4181					
=> passed	puzzle30.txt	3	0.40	34010	20714
13296					
=> passed	puzzle31.txt	3	0.47	40695	24882
15813					
=> passed	puzzle34.txt	4	2.59	148487	71312
77175					
=> passed	puzzle37.txt	4	1.05	63072	30362
32710					
=> passed	puzzle39.txt	4	0.67	40724	20098
20626					
=> passed	puzzle41.txt	5	0.53	28318	12160
16158					
=> passed	puzzle44.txt	5	3.68	153237	68934
84303					
==> 17/17 tests passed					

Total: 17/17 tests passed!

=====

Submission

Submission time	Fri-02-Oct 21:51:52
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Raw Score	35.30 / 100.00
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Feedback	See the Assessment Guide for information on how to interpret this report.
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Assessment Summary

Compilation: PASSED
Style: PASSED
Findbugs: Potential bugs found.
API: PASSED

Correctness: 22/42 tests passed
Memory: 1/8 tests passed
Timing: 0/17 tests passed

Aggregate score: 35.30% [Correctness: 65%, Memory: 10%, Timing: 25%, Style: 0%]

Assessment Details

The following files were submitted:

total 20K
-rw-r--r-- 1 4.7K Oct 3 04:52 Board.java
-rw-r--r-- 1 5.0K Oct 3 04:52 Solver.java
-rw-r--r-- 1 3.0K Oct 3 04:52 studentSubmission.zip

* compiling

% javac Board.java
*-----

=====

% javac Solver.java
*-----

Note: Solver.java uses unchecked or unsafe operations.
Note: Recompile with -Xlint:unchecked for details.

=====

```
% checkstyle *.java
```

```
*-----
```

```
=====
```

```
% findbugs *.class
```

```
*-----
```

```
M P UUF_UNUSED_FIELD UuF: Unused field: Board.manhattanDist In Board.java
```

```
M P UUF_UNUSED_FIELD UuF: Unused field: Board.hammingDist In Board.java
```

```
Warnings generated: 2
```

```
=====
```

```
Testing the APIs of your programs.
```

```
*-----
```

```
Board:
```

```
Solver:
```

```
=====
```

```
*****
```

```
*****
```

```
* correctness
```

```
*****
```

```
*****
```

```
Testing methods in Board
```

```
*-----
```

```
Running 22 total tests.
```

```
Tests 5, 6, 13, and 14 rely upon toString() returning results in prescribed format.
```

```
Test 1a: Test hamming() with file inputs
```

```
* puzzle04.txt
```

```
* puzzle00.txt
```

```
* puzzle07.txt
```

```
* puzzle17.txt
```

```
* puzzle27.txt
```

- * puzzle2x2-unsolvable1.txt

==> passed

Test 1b: Test hamming() with random N-by-N boards

- * 2-by-2

- * 3-by-3

- * 4-by-4

- * 5-by-5

- * 9-by-9

- * 10-by-10

- * 127-by-127

==> passed

Test 2a: Test manhattan() with file inputs

- * puzzle04.txt

- * puzzle00.txt

- * puzzle07.txt

- * puzzle17.txt

- * puzzle27.txt

- * puzzle2x2-unsolvable1.txt

==> passed

Test 2b: Test manhattan() with random N-by-N boards

- * 2-by-2

- * 3-by-3

- * 4-by-4

- * 5-by-5

- * 9-by-9

- * 10-by-10

- * 127-by-127

==> passed

Test 3: Test dimension() with random N-by-N boards

- * 2-by-2

- * 3-by-3

- * 4-by-4

- * 5-by-5

==> passed

Test 4a: Test toString() with file inputs

- * puzzle04.txt

- * puzzle00.txt

- * puzzle06.txt

- * puzzle09.txt

- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 4b: Test toString() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 5a: Test neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 5b: Test neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 6a: Test neighbors() of neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 6b: Test neighbors() of neighbors() with random N-by-N boards

- * 2-by-2

- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 7a: Test twin() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 7b: Test twin() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 8a: Test isGoal() on file inputs

- * puzzle00.txt
- * puzzle04.txt
- * puzzle16.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt
- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-00.txt
- * puzzle4x4-00.txt

==> passed

Test 8b: Test isGoal() on N-by-N goal boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 6-by-6

- * 100-by-100

==> passed

Test 9: Check whether two Board objects can be created at the same time

- * random 3-by-3 and 3-by-3 boards
- * random 4-by-4 and 4-by-4 boards
- * random 2-by-2 and 2-by-2 boards
- * random 3-by-3 and 4-by-4 boards
- * random 4-by-4 and 3-by-3 boards

==> passed

Test 10a: Check equals()

- * reflexive
- * symmetric
- * checks that individual entries of array are equal
- * argument is object of type String
- * argument is object of type Object
- * argument is null
- * argument is Board of different dimension

==> passed

Test 10b: Test equals() on M-by-M vs. N-by-N goal boards

- * M = 2, N = 2
- * M = 3, N = 3
- * M = 4, N = 4
- * M = 2, N = 5
- * M = 5, N = 2

==> passed

Test 11: Check that Board is immutable by changing argument array after

construction and making sure Board does not mutate

==> passed

Test 12: Check that Board is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle10.txt
- * puzzle20.txt
- * puzzle30.txt
- * 2-by-2
- * 3-by-3
- * 4-by-4

==> passed

Test 13: Call hamming() on a board that is kth-neighbor of a board

- * 0th neighbor of puzzle27.txt
- * 1th neighbor of puzzle27.txt
- * 2th neighbor of puzzle27.txt
- * 13th neighbor of puzzle27.txt
- * 13th neighbor of puzzle00.txt
- * 13th neighbor of puzzle2x2-unsolvable1.txt

==> passed

Test 14: Call manhattan() on a board that is a kth-neighbor of a board

- * 0th neighbor of puzzle27.txt
- * 1th neighbor of puzzle27.txt
- * 2th neighbor of puzzle27.txt
- * 13th neighbor of puzzle27.txt
- * 13th neighbor of puzzle00.txt
- * 13th neighbor of puzzle2x2-unsolvable1.txt

==> passed

Total: 22/22 tests passed!

=====

* correctness (substituting reference Board.java)

Testing methods in Solver

*-----

Running 20 total tests.

Test 1: Call moves() with file inputs

- * puzzle00.txt
- * puzzle01.txt

2

1 0

3 2

priorities: 1

moves: 0

2

```
1 2
3 0
priorities: 1
moves: 1
    * puzzle02.txt
9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 0 71
73 74 75 76 77 78 79 80 72
priorities: 2
moves: 0
9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 0
73 74 75 76 77 78 79 80 72
priorities: 2
moves: 1
9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 72
73 74 75 76 77 78 79 80 0
priorities: 2
moves: 2
    * puzzle03.txt
2
2 0
```



```
1 3
priorities: 3
moves: 0
2
0 2
1 3
priorities: 3
moves: 1
2
1 2
0 3
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3
    * puzzle04.txt
3
0 1 3
4 2 5
7 8 6
priorities: 4
moves: 0
3
1 0 3
4 2 5
7 8 6
priorities: 4
moves: 1
3
1 2 3
4 0 5
7 8 6
priorities: 4
moves: 2
3
1 2 3
4 5 0
7 8 6
priorities: 4
moves: 3
3
```

```
1 2 3
4 5 6
7 8 0
priorities: 4
moves: 4
* puzzle05.txt
```

```
3
4 1 3
0 2 6
7 5 8
priorities: 5
moves: 0
```

```
3
0 1 3
4 2 6
7 5 8
priorities: 5
moves: 1
```

```
3
1 0 3
4 2 6
7 5 8
priorities: 5
moves: 2
```

```
3
1 2 3
4 0 6
7 5 8
priorities: 5
moves: 3
```

```
3
1 2 3
4 5 6
7 0 8
priorities: 5
moves: 4
```

```
3
1 2 3
4 5 6
7 8 0
priorities: 5
moves: 5
* puzzle06.txt
```

```
4
```

0 1 2 3
5 6 7 4
9 10 11 8
13 14 15 12
priorities: 6
moves: 0

4
1 0 2 3
5 6 7 4
9 10 11 8
13 14 15 12
priorities: 6
moves: 1

4
1 2 0 3
5 6 7 4
9 10 11 8
13 14 15 12
priorities: 6
moves: 2

4
1 2 3 0
5 6 7 4
9 10 11 8
13 14 15 12
priorities: 6
moves: 3

4
1 2 3 4
5 6 7 0
9 10 11 8
13 14 15 12
priorities: 6
moves: 4

4
1 2 3 4
5 6 7 8
9 10 11 0
13 14 15 12
priorities: 6
moves: 5

4
1 2 3 4
5 6 7 8

9 10 11 12
13 14 15 0
priorities: 6
moves: 6
* puzzle07.txt

3
1 2 3
0 7 6
5 4 8
priorities: 7
moves: 0

3
1 2 3
5 7 6
0 4 8
priorities: 7
moves: 1

3
1 2 3
5 7 6
4 0 8
priorities: 7
moves: 2

3
1 2 3
5 7 6
4 8 0
priorities: 7
moves: 3

3
1 2 3
5 0 6
4 7 8
priorities: 7
moves: 3

3
1 2 3
0 5 6
4 7 8
priorities: 7
moves: 4

3
1 2 3
4 5 6

```
0 7 8
priorities: 7
moves: 5
3
1 2 3
4 5 6
7 0 8
priorities: 7
moves: 6
3
1 2 3
4 5 6
7 8 0
priorities: 7
moves: 7
* puzzle08.txt
```

```
3
2 3 5
1 0 4
7 8 6
priorities: 8
moves: 0
```

```
3
2 3 5
1 4 0
7 8 6
priorities: 8
moves: 1
```

```
3
2 3 5
1 4 6
7 8 0
priorities: 8
moves: 2
```

```
3
2 3 0
1 4 5
7 8 6
priorities: 8
moves: 2
```

```
3
2 0 3
1 4 5
7 8 6
```

priorities: 8

moves: 3

3

0 2 3

1 4 5

7 8 6

priorities: 8

moves: 4

3

1 2 3

0 4 5

7 8 6

priorities: 8

moves: 5

3

1 2 3

4 0 5

7 8 6

priorities: 8

moves: 6

3

1 2 3

4 5 0

7 8 6

priorities: 8

moves: 7

3

1 2 3

4 5 6

7 8 0

priorities: 8

moves: 8

* puzzle09.txt

4

2 0 3 4

1 10 6 8

5 9 7 12

13 14 11 15

priorities: 9

moves: 0

4

0 2 3 4

1 10 6 8

5 9 7 12

13 14 11 15
priorities: 9
moves: 1
4
1 2 3 4
0 10 6 8
5 9 7 12
13 14 11 15
priorities: 9
moves: 2
4
1 2 3 4
5 10 6 8
0 9 7 12
13 14 11 15
priorities: 9
moves: 3
4
1 2 3 4
5 10 6 8
9 0 7 12
13 14 11 15
priorities: 9
moves: 4
4
1 2 3 4
5 0 6 8
9 10 7 12
13 14 11 15
priorities: 9
moves: 5
4
1 2 3 4
5 6 0 8
9 10 7 12
13 14 11 15
priorities: 9
moves: 6
4
1 2 3 4
5 6 7 8
9 10 0 12
13 14 11 15
priorities: 9

```
moves: 7
4
 1  2  3  4
 5  6  7  8
 9 10 11 12
13 14  0 15
priorities: 9
moves: 8
4
 1  2  3  4
 5  6  7  8
 9 10 11 12
13 14 15  0
priorities: 9
moves: 9
  * puzzle10.txt
```

```
9
 1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64  0 65 67 68 78 69 70 72
73 74 66 75 76 77 79 71 80
priorities: 10
moves: 0
```

```
9
 1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65  0 67 68 78 69 70 72
73 74 66 75 76 77 79 71 80
priorities: 10
moves: 1
```

```
9
 1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
```


28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 0 75 76 77 79 71 80

priorities: 10

moves: 2

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 75 0 76 77 79 71 80

priorities: 10

moves: 3

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 75 76 0 77 79 71 80

priorities: 10

moves: 4

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 75 76 77 0 79 71 80

priorities: 10

moves: 5

9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 0 69 70 72
73 74 75 76 77 78 79 71 80
priorities: 10
moves: 6

9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 0 70 72
73 74 75 76 77 78 79 71 80
priorities: 10
moves: 7

9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 0 72
73 74 75 76 77 78 79 71 80
priorities: 10
moves: 8

9
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63

```
64 65 66 67 68 69 70 71 72
73 74 75 76 77 78 79  0 80
priorities: 10
moves: 9
9
 1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 72
73 74 75 76 77 78 79 80  0
priorities: 10
moves: 10
  *  puzzle11.txt
3
 1  0  2
 7  5  4
 8  6  3
priorities: 9
moves: 0
3
 1  2  0
 7  5  4
 8  6  3
priorities: 9
moves: 1
3
 1  2  4
 7  5  0
 8  6  3
priorities: 11
moves: 2
3
 1  2  4
 7  5  3
 8  6  0
priorities: 11
moves: 3
3
 1  2  4
 7  5  3
```

8 0 6
priorities: 11
moves: 4
3
1 2 4
7 5 3
0 8 6
priorities: 11
moves: 5
3
1 2 4
0 5 3
7 8 6
priorities: 11
moves: 6
3
1 5 2
7 0 4
8 6 3
priorities: 11
moves: 1
3
1 5 2
7 6 4
8 0 3
priorities: 11
moves: 2
3
1 5 2
7 6 4
0 8 3
priorities: 11
moves: 3
3
1 5 2
0 6 4
7 8 3
priorities: 11
moves: 4
3
1 5 2
7 4 0
8 6 3
priorities: 11

moves: 2
3
1 5 2
7 4 3
8 6 0
priorities: 11
moves: 3
3
1 5 2
7 4 3
8 0 6
priorities: 11
moves: 4
3
1 5 2
7 4 3
0 8 6
priorities: 11
moves: 5
3
1 5 2
0 4 3
7 8 6
priorities: 11
moves: 6
3
1 5 2
4 0 3
7 8 6
priorities: 11
moves: 7
3
1 0 2
4 5 3
7 8 6
priorities: 11
moves: 8
3
1 2 0
4 5 3
7 8 6
priorities: 11
moves: 9
3

```
1 2 3
4 5 0
7 8 6
priorities: 11
moves: 10
3
1 2 3
4 5 6
7 8 0
priorities: 11
moves: 11
* puzzle12.txt
```

```
5
1 2 3 4 5
12 6 8 9 10
0 7 13 19 14
11 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 0
```

```
5
1 2 3 4 5
12 6 8 9 10
11 7 13 19 14
0 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 1
```

```
5
1 2 3 4 5
12 6 8 9 10
11 7 13 19 14
16 0 17 18 15
21 22 23 24 20
priorities: 12
moves: 2
```

```
5
1 2 3 4 5
12 6 8 9 10
11 7 13 19 14
16 17 0 18 15
21 22 23 24 20
priorities: 12
moves: 3
```

5
1 2 3 4 5
12 6 8 9 10
11 7 13 19 14
16 17 18 0 15
21 22 23 24 20
priorities: 12
moves: 4

5
1 2 3 4 5
12 6 8 9 10
11 7 13 0 14
16 17 18 19 15
21 22 23 24 20
priorities: 12
moves: 5

5
1 2 3 4 5
12 6 8 9 10
11 7 13 14 0
16 17 18 19 15
21 22 23 24 20
priorities: 12
moves: 6

5
1 2 3 4 5
12 6 8 9 10
11 7 13 14 15
16 17 18 19 0
21 22 23 24 20
priorities: 12
moves: 7

5
1 2 3 4 5
12 6 8 9 10
11 7 13 14 15
16 17 18 19 20
21 22 23 24 0
priorities: 12
moves: 8

5
1 2 3 4 5
0 6 8 9 10
12 7 13 19 14

11 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 1
5
1 2 3 4 5
6 0 8 9 10
12 7 13 19 14
11 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 2
5
1 2 3 4 5
6 7 8 9 10
12 0 13 19 14
11 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 3
5
1 2 3 4 5
6 7 8 9 10
0 12 13 19 14
11 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 4
5
1 2 3 4 5
6 7 8 9 10
11 12 13 19 14
0 16 17 18 15
21 22 23 24 20
priorities: 12
moves: 5
5
1 2 3 4 5
6 7 8 9 10
11 12 13 19 14
16 0 17 18 15
21 22 23 24 20
priorities: 12
moves: 6

5
1 2 3 4 5
6 7 8 9 10
11 12 13 19 14
16 17 0 18 15
21 22 23 24 20
priorities: 12
moves: 7

5
1 2 3 4 5
6 7 8 9 10
11 12 13 19 14
16 17 18 0 15
21 22 23 24 20
priorities: 12
moves: 8

5
1 2 3 4 5
6 7 8 9 10
11 12 13 0 14
16 17 18 19 15
21 22 23 24 20
priorities: 12
moves: 9

5
1 2 3 4 5
6 7 8 9 10
11 12 13 14 0
16 17 18 19 15
21 22 23 24 20
priorities: 12
moves: 10

5
1 2 3 4 5
6 7 8 9 10
11 12 13 14 15
16 17 18 19 0
21 22 23 24 20
priorities: 12
moves: 11

5
1 2 3 4 5
6 7 8 9 10
11 12 13 14 15

16 17 18 19 20
21 22 23 24 0
priorities: 12
moves: 12
* puzzle13.txt

4
2 3 4 8
1 6 0 12
5 10 7 11
9 13 14 15
priorities: 13
moves: 0

4
2 3 4 8
1 6 7 12
5 10 0 11
9 13 14 15
priorities: 13
moves: 1

4
2 3 4 8
1 6 7 12
5 10 11 0
9 13 14 15
priorities: 13
moves: 2

4
2 3 4 8
1 6 7 0
5 10 11 12
9 13 14 15
priorities: 13
moves: 3

4
2 3 4 0
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 13
moves: 4

4
2 3 0 4
1 6 7 8
5 10 11 12

9 13 14 15
priorities: 13
moves: 5
4
2 0 3 4
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 13
moves: 6
4
0 2 3 4
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 13
moves: 7
4
1 2 3 4
0 6 7 8
5 10 11 12
9 13 14 15
priorities: 13
moves: 8
4
1 2 3 4
5 6 7 8
0 10 11 12
9 13 14 15
priorities: 13
moves: 9
4
1 2 3 4
5 6 7 8
9 10 11 12
0 13 14 15
priorities: 13
moves: 10
4
1 2 3 4
5 6 7 8
9 10 11 12
13 0 14 15
priorities: 13

```
moves: 11
4
 1  2  3  4
 5  6  7  8
 9 10 11 12
13 14  0 15
priorities: 13
moves: 12
4
 1  2  3  4
 5  6  7  8
 9 10 11 12
13 14 15  0
priorities: 13
moves: 13
==> passed
```

Test 2: Call solution() with file inputs

```
* puzzle00.txt
* puzzle01.txt
2
 1  0
 3  2
priorities: 1
moves: 0
2
 1  2
 3  0
priorities: 1
moves: 1
* puzzle02.txt
9
 1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70  0 71
73 74 75 76 77 78 79 80 72
priorities: 2
moves: 0
9
```

```
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 0
73 74 75 76 77 78 79 80 72
priorities: 2
```

moves: 1

9

```
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 72
73 74 75 76 77 78 79 80 0
priorities: 2
```

moves: 2

* puzzle03.txt

2

2 0

1 3

priorities: 3

moves: 0

2

0 2

1 3

priorities: 3

moves: 1

2

1 2

0 3

priorities: 3

moves: 2

2

1 2

3 0

priorities: 3

moves: 3

* puzzle04.txt

3

0 1 3

4 2 5

7 8 6

priorities: 4

moves: 0

3

1 0 3

4 2 5

7 8 6

priorities: 4

moves: 1

3

1 2 3

4 0 5

7 8 6

priorities: 4

moves: 2

3

1 2 3

4 5 0

7 8 6

priorities: 4

moves: 3

3

1 2 3

4 5 6

7 8 0

priorities: 4

moves: 4

* puzzle05.txt

3

4 1 3

0 2 6

7 5 8

priorities: 5

moves: 0

3

0 1 3

4 2 6

7 5 8

priorities: 5

moves: 1

```

3
  1  0  3
  4  2  6
  7  5  8
priorities: 5
moves: 2
3
  1  2  3
  4  0  6
  7  5  8
priorities: 5
moves: 3
3
  1  2  3
  4  5  6
  7  0  8
priorities: 5
moves: 4
3
  1  2  3
  4  5  6
  7  8  0
priorities: 5
moves: 5
  * puzzle06.txt
4
  0  1  2  3
  5  6  7  4
  9 10 11  8
13 14 15 12
priorities: 6
moves: 0
4
  1  0  2  3
  5  6  7  4
  9 10 11  8
13 14 15 12
priorities: 6
moves: 1
4
  1  2  0  3
  5  6  7  4
  9 10 11  8
13 14 15 12

```

priorities: 6

moves: 2

4

1 2 3 0

5 6 7 4

9 10 11 8

13 14 15 12

priorities: 6

moves: 3

4

1 2 3 4

5 6 7 0

9 10 11 8

13 14 15 12

priorities: 6

moves: 4

4

1 2 3 4

5 6 7 8

9 10 11 0

13 14 15 12

priorities: 6

moves: 5

4

1 2 3 4

5 6 7 8

9 10 11 12

13 14 15 0

priorities: 6

moves: 6

* puzzle07.txt

3

1 2 3

0 7 6

5 4 8

priorities: 7

moves: 0

3

1 2 3

5 7 6

0 4 8

priorities: 7

moves: 1

3


```
1 2 3
5 7 6
4 0 8
priorities: 7
moves: 2
3
1 2 3
5 7 6
4 8 0
priorities: 7
moves: 3
3
1 2 3
5 0 6
4 7 8
priorities: 7
moves: 3
3
1 2 3
0 5 6
4 7 8
priorities: 7
moves: 4
3
1 2 3
4 5 6
0 7 8
priorities: 7
moves: 5
3
1 2 3
4 5 6
7 0 8
priorities: 7
moves: 6
3
1 2 3
4 5 6
7 8 0
priorities: 7
moves: 7
* puzzle08.txt
3
2 3 5
```

```
1 0 4
7 8 6
priorities: 8
moves: 0
3
2 3 5
1 4 0
7 8 6
priorities: 8
moves: 1
3
2 3 5
1 4 6
7 8 0
priorities: 8
moves: 2
3
2 3 0
1 4 5
7 8 6
priorities: 8
moves: 2
3
2 0 3
1 4 5
7 8 6
priorities: 8
moves: 3
3
0 2 3
1 4 5
7 8 6
priorities: 8
moves: 4
3
1 2 3
0 4 5
7 8 6
priorities: 8
moves: 5
3
1 2 3
4 0 5
7 8 6
```

priorities: 8

moves: 6

3

1 2 3

4 5 0

7 8 6

priorities: 8

moves: 7

3

1 2 3

4 5 6

7 8 0

priorities: 8

moves: 8

* puzzle10.txt

9

1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27

28 29 30 31 32 33 34 35 36

37 38 39 40 41 42 43 44 45

46 47 48 49 50 51 52 53 54

55 56 57 58 59 60 61 62 63

64 0 65 67 68 78 69 70 72

73 74 66 75 76 77 79 71 80

priorities: 10

moves: 0

9

1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27

28 29 30 31 32 33 34 35 36

37 38 39 40 41 42 43 44 45

46 47 48 49 50 51 52 53 54

55 56 57 58 59 60 61 62 63

64 65 0 67 68 78 69 70 72

73 74 66 75 76 77 79 71 80

priorities: 10

moves: 1

9

1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27

28 29 30 31 32 33 34 35 36

37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 0 75 76 77 79 71 80

priorities: 10

moves: 2

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 75 0 76 77 79 71 80

priorities: 10

moves: 3

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 75 76 0 77 79 71 80

priorities: 10

moves: 4

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 78 69 70 72
73 74 75 76 77 0 79 71 80

priorities: 10

moves: 5

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 0 69 70 72
73 74 75 76 77 78 79 71 80
priorities: 10

moves: 6

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 0 70 72
73 74 75 76 77 78 79 71 80
priorities: 10

moves: 7

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 0 72
73 74 75 76 77 78 79 71 80
priorities: 10

moves: 8

9

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 72

```

73 74 75 76 77 78 79  0 80
priorities: 10
moves: 9
9
  1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45
46 47 48 49 50 51 52 53 54
55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 72
73 74 75 76 77 78 79 80  0
priorities: 10
moves: 10
  * puzzle15.txt
8
  1  2  3  4  5  6  7  8
  9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
  0 25 27 28 29 30 31 32
34 26 35 36 37 38 39 40
33 41 42 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 0
8
  1  2  3  4  5  6  7  8
  9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25  0 27 28 29 30 31 32
34 26 35 36 37 38 39 40
33 41 42 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 1
8
  1  2  3  4  5  6  7  8
  9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
34  0 35 36 37 38 39 40

```

```
33 41 42 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 2
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
 0 34 35 36 37 38 39 40
33 41 42 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 3
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
 0 41 42 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 4
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41  0 42 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 5
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
```

```
41 42  0 43 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 6
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43  0 45 46 47 48
49 50 51 44 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 7
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51  0 61 53 54 56
57 58 59 52 60 62 55 63
priorities: 15
moves: 8
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52 61 53 54 56
57 58 59  0 60 62 55 63
priorities: 15
moves: 9
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
```



```
41 42 43 44 45 46 47 48
49 50 51 52 61 53 54 56
57 58 59 60  0 62 55 63
priorities: 15
moves: 10
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52  0 53 54 56
57 58 59 60 61 62 55 63
priorities: 15
moves: 11
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52 53  0 54 56
57 58 59 60 61 62 55 63
priorities: 15
moves: 12
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52 53 54  0 56
57 58 59 60 61 62 55 63
priorities: 15
moves: 13
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
```

```
41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56
57 58 59 60 61 62 0 63
priorities: 15
moves: 14
8
 1  2  3  4  5  6  7  8
 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56
57 58 59 60 61 62 63 0
priorities: 15
moves: 15
==> passed
```

Test 3: Create two Solver objects at the same time
* puzzle04.txt and puzzle04.txt

```
3
0  1  3
4  2  5
7  8  6
priorities: 4
moves: 0
3
1  0  3
4  2  5
7  8  6
priorities: 4
moves: 1
3
1  2  3
4  0  5
7  8  6
priorities: 4
moves: 2
3
1  2  3
4  5  0
7  8  6
priorities: 4
moves: 3
```

3
1 2 3
4 5 6
7 8 0
priorities: 4
moves: 4

3
0 1 3
4 2 5
7 8 6
priorities: 4
moves: 0

3
1 0 3
4 2 5
7 8 6
priorities: 4
moves: 1

3
1 2 3
4 0 5
7 8 6
priorities: 4
moves: 2

3
1 2 3
4 5 0
7 8 6
priorities: 4
moves: 3

3
1 2 3
4 5 6
7 8 0
priorities: 4
moves: 4

* puzzle00.txt and puzzle04.txt

3
0 1 3
4 2 5
7 8 6
priorities: 4
moves: 0

3

```
1 0 3
4 2 5
7 8 6
priorities: 4
moves: 1
3
1 2 3
4 0 5
7 8 6
priorities: 4
moves: 2
3
1 2 3
4 5 0
7 8 6
priorities: 4
moves: 3
3
1 2 3
4 5 6
7 8 0
priorities: 4
moves: 4
    * puzzle04.txt and puzzle00.txt
3
0 1 3
4 2 5
7 8 6
priorities: 4
moves: 0
3
1 0 3
4 2 5
7 8 6
priorities: 4
moves: 1
3
1 2 3
4 0 5
7 8 6
priorities: 4
moves: 2
3
1 2 3
```

```
4 5 0
7 8 6
priorities: 4
moves: 3
3
1 2 3
4 5 6
7 8 0
priorities: 4
moves: 4
==> passed
```

Test 4a: Call isSolvable() with file inputs

```
* puzzle01.txt
```

```
2
1 0
3 2
priorities: 1
moves: 0
```

```
2
1 2
3 0
priorities: 1
moves: 1
```

```
* puzzle03.txt
```

```
2
2 0
1 3
priorities: 3
moves: 0
```

```
2
0 2
1 3
priorities: 3
moves: 1
```

```
2
1 2
0 3
priorities: 3
moves: 2
```

```
2
1 2
3 0
priorities: 3
```

moves: 3
* puzzle04.txt

3
0 1 3
4 2 5
7 8 6

priorities: 4

moves: 0

3
1 0 3
4 2 5
7 8 6

priorities: 4

moves: 1

3
1 2 3
4 0 5
7 8 6

priorities: 4

moves: 2

3
1 2 3
4 5 0
7 8 6

priorities: 4

moves: 3

3
1 2 3
4 5 6
7 8 0

priorities: 4

moves: 4

* puzzle17.txt

3
5 1 8
2 7 3
4 0 6

priorities: 13

moves: 0

3
5 1 8
2 0 3
4 7 6

priorities: 13

moves: 1
3
5 1 8
0 2 3
4 7 6
priorities: 13
moves: 2
3
5 1 8
4 2 3
0 7 6
priorities: 13
moves: 3
3
5 1 8
4 2 3
7 0 6
priorities: 13
moves: 4
3
0 1 8
5 2 3
4 7 6
priorities: 13
moves: 3
3
1 0 8
5 2 3
4 7 6
priorities: 13
moves: 4
3
1 2 8
5 0 3
4 7 6
priorities: 13
moves: 5
3
1 2 8
0 5 3
4 7 6
priorities: 13
moves: 6
3

1 2 8
4 5 3
0 7 6
priorities: 13
moves: 7
3

1 2 8
4 5 3
7 0 6
priorities: 13
moves: 8
3

1 8 0
5 2 3
4 7 6
priorities: 13
moves: 5
3

1 8 3
5 2 0
4 7 6
priorities: 13
moves: 6
3

1 8 3
5 2 6
4 7 0
priorities: 13
moves: 7
3

1 2 8
4 5 3
7 6 0
priorities: 15
moves: 9
3

1 2 8
4 0 3
7 5 6
priorities: 15
moves: 9
3

1 8 3
5 2 6

4 0 7
priorities: 15
moves: 8
3
0 2 8
1 5 3
4 7 6
priorities: 15
moves: 7
3
1 8 3
5 0 2
4 7 6
priorities: 15
moves: 7
3
1 8 3
0 5 2
4 7 6
priorities: 15
moves: 8
3
1 8 3
4 5 2
0 7 6
priorities: 15
moves: 9
3
1 8 3
4 5 2
7 0 6
priorities: 15
moves: 10
3
1 0 3
5 8 2
4 7 6
priorities: 15
moves: 8
3
1 2 8
5 7 3
4 0 6
priorities: 15

moves: 6
3
1 2 8
5 3 0
4 7 6
priorities: 15
moves: 6
3
1 2 8
5 3 6
4 7 0
priorities: 15
moves: 7
3
1 2 0
5 3 8
4 7 6
priorities: 15
moves: 7
3
5 1 8
4 2 3
7 6 0
priorities: 15
moves: 5
3
5 1 8
4 0 3
7 2 6
priorities: 15
moves: 5
3
5 0 8
2 1 3
4 7 6
priorities: 15
moves: 2
3
5 8 0
2 1 3
4 7 6
priorities: 15
moves: 3
3

5 8 3
2 1 0
4 7 6
priorities: 15
moves: 4
3

5 8 3
2 1 6
4 7 0
priorities: 15
moves: 5
3

0 5 8
2 1 3
4 7 6
priorities: 15
moves: 3
3

2 5 8
0 1 3
4 7 6
priorities: 15
moves: 4
3

2 5 8
4 1 3
0 7 6
priorities: 15
moves: 5
3

2 5 8
4 1 3
7 0 6
priorities: 15
moves: 6
3

2 5 8
1 0 3
4 7 6
priorities: 15
moves: 5
3

2 0 8
1 5 3

4 7 6
priorities: 15
moves: 6
3
2 8 0
1 5 3
4 7 6
priorities: 15
moves: 7
3
2 8 3
1 5 0
4 7 6
priorities: 15
moves: 8
3
2 8 3
1 5 6
4 7 0
priorities: 15
moves: 9
3
0 2 8
1 5 3
4 7 6
priorities: 15
moves: 7
3
1 2 8
0 5 3
4 7 6
priorities: 15
moves: 8
3
1 2 8
4 5 3
0 7 6
priorities: 15
moves: 9
3
1 2 8
4 5 3
7 0 6
priorities: 15

moves: 10

3

5 1 8

2 3 0

4 7 6

priorities: 15

moves: 2

3

5 1 8

2 3 6

4 7 0

priorities: 15

moves: 3

3

5 1 0

2 3 8

4 7 6

priorities: 15

moves: 3

3

5 1 8

2 7 3

0 4 6

priorities: 15

moves: 1

3

5 1 8

2 7 3

4 6 0

priorities: 15

moves: 1

3

1 8 3

4 5 2

7 6 0

priorities: 17

moves: 11

3

1 2 8

4 5 3

7 6 0

priorities: 17

moves: 11

3

1 2 8
4 0 3
7 5 6
priorities: 17
moves: 11
3

1 8 3
4 0 2
7 5 6
priorities: 17
moves: 11
3

1 8 3
4 2 0
7 5 6
priorities: 17
moves: 12
3

1 8 3
4 2 6
7 5 0
priorities: 17
moves: 13
3

1 0 3
4 8 2
7 5 6
priorities: 17
moves: 12
3

1 0 8
4 2 3
7 5 6
priorities: 17
moves: 10
3

1 8 0
4 2 3
7 5 6
priorities: 17
moves: 11
3

1 8 3
4 2 0

7 5 6
priorities: 17
moves: 12
3
1 8 3
4 2 6
7 5 0

priorities: 17
moves: 13
3
2 8 3
1 5 6
4 0 7

priorities: 17
moves: 10
3
1 2 8
4 3 0
7 5 6

priorities: 17
moves: 10
3
1 2 8
4 3 6
7 5 0

priorities: 17
moves: 11
3
1 2 0
4 3 8
7 5 6

priorities: 17
moves: 11
3
1 2 8
4 5 0
7 6 3

priorities: 17
moves: 10
3
1 2 0
4 5 8
7 6 3

priorities: 17

moves: 11

3

1 2 8

0 4 3

7 5 6

priorities: 17

moves: 10

3

0 8 3

1 5 2

4 7 6

priorities: 17

moves: 9

3

2 8 3

1 0 5

4 7 6

priorities: 17

moves: 9

3

2 0 3

1 8 5

4 7 6

priorities: 17

moves: 10

3

0 2 3

1 8 5

4 7 6

priorities: 17

moves: 11

3

1 2 3

0 8 5

4 7 6

priorities: 17

moves: 12

3

1 2 3

4 8 5

0 7 6

priorities: 17

moves: 13

3


```
1 2 3
4 8 5
7 0 6
priorities: 17
moves: 14
```

```
3
1 2 3
4 0 5
7 8 6
priorities: 17
moves: 15
```

```
3
1 2 3
4 5 0
7 8 6
priorities: 17
moves: 16
```

```
3
1 2 3
4 5 6
7 8 0
priorities: 17
moves: 17
```

```
* puzzle3x3-unsolvable1.txt
```

```
3
1 2 3
4 6 5
7 8 0
priorities: 2
moves: 0
```

```
3
1 2 3
4 6 5
7 0 8
priorities: 4
moves: 1
```

```
3
1 2 3
4 6 0
7 8 5
priorities: 4
moves: 1
```

```
3
1 2 3
```

4 0 6

7 8 5

priorities: 4

moves: 2

3

1 2 3

4 8 6

7 0 5

priorities: 6

moves: 3

3

1 2 3

4 8 6

7 5 0

priorities: 6

moves: 4

3

1 2 3

0 4 6

7 8 5

priorities: 6

moves: 3

3

1 0 3

4 2 6

7 8 5

priorities: 6

moves: 3

3

1 2 3

4 0 5

7 6 8

priorities: 6

moves: 2

3

1 2 3

4 5 0

7 6 8

priorities: 6

moves: 3

3

1 2 3

4 6 5

0 7 8

priorities: 6

moves: 2

3

1 2 0

4 6 3

7 8 5

priorities: 6

moves: 2

3

1 2 3

4 8 0

7 5 6

priorities: 8

moves: 5

3

1 2 0

4 5 3

7 6 8

priorities: 8

moves: 4

3

1 3 0

4 2 6

7 8 5

priorities: 8

moves: 4

3

0 2 3

1 4 6

7 8 5

priorities: 8

moves: 4

3

0 1 3

4 2 6

7 8 5

priorities: 8

moves: 4

3

1 2 3

4 5 8

7 6 0

priorities: 8

moves: 4

3
1 2 3
4 5 8
7 0 6
priorities: 8
moves: 5

3
1 2 3
4 8 6
0 7 5
priorities: 8
moves: 4

3
1 2 3
7 4 6
0 8 5
priorities: 8
moves: 4

3
1 0 3
4 2 5
7 6 8
priorities: 8
moves: 3

3
1 0 2
4 6 3
7 8 5
priorities: 8
moves: 3

3
1 2 3
0 4 5
7 6 8
priorities: 8
moves: 3

3
1 2 3
0 6 5
4 7 8
priorities: 8
moves: 3

3
1 2 0

4 8 3
7 5 6
priorities: 10
moves: 6
3
1 2 3
4 0 8
7 5 6
priorities: 10
moves: 6
3
1 2 3
4 5 8
7 0 6
priorities: 10
moves: 7
3
1 2 3
4 5 8
0 7 6
priorities: 10
moves: 6
3
1 2 3
4 0 8
7 5 6
priorities: 10
moves: 6
3
1 2 3
4 8 0
7 5 6
priorities: 10
moves: 7
3
1 2 3
4 8 6
7 5 0
priorities: 10
moves: 8
3
1 2 3
0 8 6
4 7 5

priorities: 10

moves: 5

3

2 0 3

1 4 6

7 8 5

priorities: 10

moves: 5

3

1 3 6

4 2 0

7 8 5

priorities: 10

moves: 5

3

1 3 6

4 2 5

7 8 0

priorities: 10

moves: 6

3

1 0 2

4 5 3

7 6 8

priorities: 10

moves: 5

3

1 2 3

7 4 6

8 0 5

priorities: 10

moves: 5

3

1 2 3

7 4 6

8 5 0

priorities: 10

moves: 6

3

4 1 3

0 2 6

7 8 5

priorities: 10

moves: 5

3
0 1 3
4 2 5
7 6 8
priorities: 10
moves: 4

3
1 2 3
7 4 5
0 6 8
priorities: 10
moves: 4

3
1 2 3
6 0 5
4 7 8
priorities: 10
moves: 4

3
1 2 3
6 5 0
4 7 8
priorities: 10
moves: 5

3
0 2 3
1 4 5
7 6 8
priorities: 10
moves: 4

3
0 1 2
4 6 3
7 8 5
priorities: 10
moves: 4

3
1 3 0
4 2 5
7 6 8
priorities: 10
moves: 4

3
0 2 3

1 6 5
4 7 8
priorities: 10
moves: 4
3
1 6 2
4 0 3
7 8 5
priorities: 10
moves: 4
3
1 2 3
4 8 6
7 0 5
priorities: 12
moves: 9
3
1 2 3
4 0 6
7 8 5
priorities: 12
moves: 10
3
1 2 0
4 8 3
7 5 6
priorities: 12
moves: 8
3
1 2 3
4 5 8
7 6 0
priorities: 12
moves: 8
3
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priorities: 20
moves: 2
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priorities: 20
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priorities: 20
moves: 5
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moves: 18

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3

1 2 6
0 8 3
4 5 7
priorities: 24
moves: 17
3

1 2 6
4 8 3
0 5 7
priorities: 24
moves: 18

3
2 6 0
4 8 3
1 7 5
priorities: 24
moves: 14

3
2 6 3
4 8 0
1 7 5
priorities: 24
moves: 15

3
2 6 3
4 8 5
1 7 0
priorities: 24
moves: 16

3
2 8 6
1 5 4
7 3 0
priorities: 24
moves: 14

3
2 8 6
1 0 4
7 5 3
priorities: 24
moves: 14

3
2 8 6
1 4 0

7 5 3
priorities: 24
moves: 15
3
2 8 6
1 4 3
7 5 0
priorities: 24
moves: 16
3
2 8 0
1 4 6
7 5 3
priorities: 24
moves: 16
3
2 0 6
1 8 4
7 5 3
priorities: 24
moves: 15
3
0 2 6
1 8 4
7 5 3
priorities: 24
moves: 16
3
1 2 6
0 8 4
7 5 3
priorities: 24
moves: 17
3
2 0 4
7 8 6
1 5 3
priorities: 24
moves: 13
3
2 4 0
7 8 6
1 5 3
priorities: 24

moves: 14
3
4 2 6
8 7 3
1 0 5
priorities: 24
moves: 13
3
4 2 6
8 0 3
1 7 5
priorities: 24
moves: 14
3
4 2 6
0 8 3
1 7 5
priorities: 24
moves: 15
3
4 2 6
1 8 3
0 7 5
priorities: 24
moves: 16
3
4 2 6
1 8 3
7 0 5
priorities: 24
moves: 17
3
4 2 6
1 8 3
7 5 0
priorities: 24
moves: 18
3
4 2 6
1 0 3
7 8 5
priorities: 24
moves: 18
3

0 2 6
4 8 3
1 7 5
priorities: 24
moves: 16

3
4 0 2
8 7 6
1 5 3
priorities: 24
moves: 13

3
4 2 8
0 7 6
1 5 3
priorities: 24
moves: 13

3
4 2 8
1 7 6
0 5 3
priorities: 24
moves: 14

3
4 2 8
7 0 6
1 5 3
priorities: 24
moves: 14

3
4 2 8
7 5 6
1 0 3
priorities: 24
moves: 15

3
7 2 4
1 8 6
5 0 3
priorities: 24
moves: 13

3
7 2 4
1 0 6

5 8 3
priorities: 24
moves: 14
3
2 0 6
4 8 7
1 5 3
priorities: 24
moves: 13
3
4 2 6
1 8 7
5 0 3
priorities: 24
moves: 13
3
4 2 6
1 0 7
5 8 3
priorities: 24
moves: 14
3
4 2 6
1 7 0
5 8 3
priorities: 24
moves: 15
3
4 2 6
1 7 3
5 8 0
priorities: 24
moves: 16
3
4 2 0
1 7 6
5 8 3
priorities: 24
moves: 16
3
4 2 6
1 8 7
5 0 3
priorities: 24

moves: 13

3

4 2 6

1 0 7

5 8 3

priorities: 24

moves: 14

3

4 2 6

1 7 0

5 8 3

priorities: 24

moves: 15

3

4 2 6

1 7 3

5 8 0

priorities: 24

moves: 16

3

4 2 0

1 7 6

5 8 3

priorities: 24

moves: 16

3

5 2 6

0 8 3

1 4 7

priorities: 24

moves: 13

3

5 2 6

1 8 3

0 4 7

priorities: 24

moves: 14

3

5 2 6

1 8 3

4 0 7

priorities: 24

moves: 15

3

5 2 6
1 8 3
4 7 0
priorities: 24
moves: 16
3

5 2 6
1 0 3
4 8 7
priorities: 24
moves: 16
3

2 8 6
4 3 0
1 7 5
priorities: 24
moves: 13
3

2 8 6
4 3 5
1 7 0
priorities: 24
moves: 14
3

2 8 0
4 3 6
1 7 5
priorities: 24
moves: 14
3

2 4 6
7 8 0
1 5 3
priorities: 24
moves: 13
3

2 4 6
7 8 3
1 5 0
priorities: 24
moves: 14
3

2 8 6
5 4 0

1 7 3
priorities: 24
moves: 13
3
2 8 0
5 4 6
1 7 3
priorities: 24
moves: 14
3
2 8 6
0 4 3
1 7 5
priorities: 24
moves: 13
3
2 8 6
1 4 3
0 7 5
priorities: 24
moves: 14
3
2 8 6
1 4 3
7 0 5
priorities: 24
moves: 15
3
2 8 6
1 4 3
7 5 0
priorities: 24
moves: 16
3
7 2 4
0 8 6
1 5 3
priorities: 24
moves: 13
3
7 2 4
1 8 6
0 5 3
priorities: 24

moves: 14

3

8 5 6

1 2 0

4 7 3

priorities: 24

moves: 13

3

8 5 0

1 2 6

4 7 3

priorities: 24

moves: 14

3

2 0 8

5 4 6

1 7 3

priorities: 24

moves: 13

3

0 2 8

5 4 6

1 7 3

priorities: 24

moves: 14

3

2 8 6

5 4 3

1 0 7

priorities: 24

moves: 13

3

5 2 6

0 8 4

1 7 3

priorities: 24

moves: 13

3

5 2 6

1 8 4

0 7 3

priorities: 24

moves: 14

3

5 2 6

1 8 4

7 0 3

priorities: 24

moves: 15

3

5 2 6

1 0 4

7 8 3

priorities: 24

moves: 16

3

5 2 6

1 4 0

7 8 3

priorities: 24

moves: 17

3

5 2 6

1 4 3

7 8 0

priorities: 24

moves: 18

3

5 2 0

1 4 6

7 8 3

priorities: 24

moves: 18

3

2 0 8

4 5 6

1 3 7

priorities: 24

moves: 13

3

0 2 8

4 5 6

1 3 7

priorities: 24

moves: 14

3

7 2 4

8 5 6

```
0 1 3
priorities: 24
moves: 12
3
7 2 4
0 5 6
8 1 3
priorities: 24
moves: 13
3
0 2 4
7 5 6
8 1 3
priorities: 24
moves: 14
3
4 2 6
8 5 7
0 1 3
priorities: 24
moves: 12
3
4 2 6
0 5 7
8 1 3
priorities: 24
moves: 13
3
0 2 6
4 5 7
8 1 3
priorities: 24
moves: 14
3
2 7 8
4 0 6
1 5 3
priorities: 24
moves: 12
3
2 7 8
4 5 6
1 0 3
priorities: 24
```

moves: 13

3

2 8 6

5 4 3

0 1 7

priorities: 24

moves: 12

3

4 2 6

8 5 7

1 3 0

priorities: 24

moves: 12

3

4 2 6

8 5 0

1 3 7

priorities: 24

moves: 13

3

4 2 0

8 5 6

1 3 7

priorities: 24

moves: 14

3

7 2 4

8 5 6

1 3 0

priorities: 24

moves: 12

3

2 8 6

4 7 3

0 1 5

priorities: 24

moves: 12

3

2 8 6

5 0 3

1 4 7

priorities: 24

moves: 12

3

2 8 6
5 4 3
1 0 7
priorities: 24
moves: 13
3

2 8 6
5 4 3
1 7 0
priorities: 24
moves: 14

3
2 0 6
5 8 3
1 4 7
priorities: 24
moves: 13

3
0 2 6
5 8 3
1 4 7
priorities: 24
moves: 14

3
2 8 4
7 5 6
1 3 0
priorities: 24
moves: 12

3
2 8 4
7 5 6
0 1 3
priorities: 24
moves: 12

3
2 8 4
0 5 6
7 1 3
priorities: 24
moves: 13

3
2 8 6
4 0 5

1 3 7
priorities: 24
moves: 12
3
2 8 6
4 3 5
1 0 7
priorities: 24
moves: 13
3
2 8 6
4 3 5
1 7 0
priorities: 24
moves: 14
3
2 0 6
4 8 5
1 3 7
priorities: 24
moves: 13
3
0 2 6
4 8 5
1 3 7
priorities: 24
moves: 14
3
8 5 6
1 0 3
4 2 7
priorities: 24
moves: 12
3
8 0 6
1 5 3
4 2 7
priorities: 24
moves: 13
3
0 8 6
1 5 3
4 2 7
priorities: 24

moves: 14

3

1 8 6

0 5 3

4 2 7

priorities: 24

moves: 15

3

1 8 6

4 5 3

0 2 7

priorities: 24

moves: 16

3

0 8 6

2 5 3

1 4 7

priorities: 24

moves: 12

3

2 6 0

5 8 3

1 4 7

priorities: 24

moves: 12

3

2 6 3

5 8 0

1 4 7

priorities: 24

moves: 13

3

4 2 6

8 0 7

1 5 3

priorities: 24

moves: 12

3

4 2 6

8 5 7

1 0 3

priorities: 24

moves: 13

3

4 2 6
8 7 0
1 5 3
priorities: 24
moves: 13
3

4 2 6
8 7 3
1 5 0
priorities: 24
moves: 14
3

4 2 0
8 7 6
1 5 3
priorities: 24
moves: 14
3

8 5 6
1 0 4
7 2 3
priorities: 24
moves: 12
3

8 5 6
1 4 0
7 2 3
priorities: 24
moves: 13
3

8 5 6
1 4 3
7 2 0
priorities: 24
moves: 14
3

8 5 0
1 4 6
7 2 3
priorities: 24
moves: 14
3

8 0 6
1 5 4

7 2 3
priorities: 24
moves: 13
3
0 8 6
1 5 4
7 2 3
priorities: 24
moves: 14
3
1 8 6
0 5 4
7 2 3
priorities: 24
moves: 15
3
8 5 6
1 2 4
7 3 0
priorities: 24
moves: 12
3
2 8 6
5 0 4
1 7 3
priorities: 24
moves: 12
3
2 8 6
5 4 0
1 7 3
priorities: 24
moves: 13
3
2 8 6
5 4 3
1 7 0
priorities: 24
moves: 14
3
2 8 0
5 4 6
1 7 3
priorities: 24

moves: 14

3

2 0 6

5 8 4

1 7 3

priorities: 24

moves: 13

3

0 2 6

5 8 4

1 7 3

priorities: 24

moves: 14

3

0 8 6

2 5 4

1 7 3

priorities: 24

moves: 12

3

2 6 0

5 8 4

1 7 3

priorities: 24

moves: 12

3

2 8 6

0 5 7

4 1 3

priorities: 24

moves: 11

3

2 6 7

4 8 0

1 5 3

priorities: 24

moves: 11

3

2 6 7

4 8 3

1 5 0

priorities: 24

moves: 12

3

7 2 4

8 6 0

1 5 3

priorities: 24

moves: 11

3

7 2 4

8 6 3

1 5 0

priorities: 24

moves: 12

3

7 2 0

8 6 4

1 5 3

priorities: 24

moves: 12

3

2 0 8

5 3 6

1 4 7

priorities: 24

moves: 11

3

2 3 8

5 0 6

1 4 7

priorities: 24

moves: 12

3

2 3 8

5 4 6

1 0 7

priorities: 24

moves: 13

3

2 3 8

5 4 6

1 7 0

priorities: 24

moves: 14

3

2 3 8

0 5 6

1 4 7
priorities: 24
moves: 13
3

2 3 8
1 5 6
0 4 7

priorities: 24
moves: 14
3

2 3 8
1 5 6
4 0 7

priorities: 24
moves: 15
3

2 3 8
1 5 6
4 7 0

priorities: 24
moves: 16

* puzzle4x4-unsolvable.txt

4
3 2 4 8
1 6 0 12
5 10 7 11
9 13 14 15
priorities: 13
moves: 0

4
3 2 4 8
1 6 7 12
5 10 0 11
9 13 14 15

priorities: 13
moves: 1

4
3 2 4 8
1 6 7 12
5 10 11 0
9 13 14 15

priorities: 13
moves: 2

4

```
3 2 4 8
1 6 7 0
5 10 11 12
9 13 14 15
priorities: 13
moves: 3
4
3 2 4 0
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 13
moves: 4
4
3 2 0 4
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 13
moves: 5
4
3 2 7 4
1 6 0 8
5 10 11 12
9 13 14 15
priorities: 15
moves: 6
4
3 0 2 4
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 15
moves: 6
4
0 3 2 4
1 6 7 8
5 10 11 12
9 13 14 15
priorities: 15
moves: 7
4
1 3 2 4
0 6 7 8
```

```

5 10 11 12
9 13 14 15
priorities: 15
moves: 8
4
1 3 2 4
5 6 7 8
0 10 11 12
9 13 14 15
priorities: 15
moves: 9
4
1 3 2 4
5 6 7 8
9 10 11 12
0 13 14 15
priorities: 15
moves: 10
4
1 3 2 4
5 6 7 8
9 10 11 12
13 0 14 15
priorities: 15
moves: 11
4
1 3 2 4
5 6 7 8
9 10 11 12
13 14 0 15
priorities: 15
moves: 12
==> passed

```

Test 4b: Call isSolvable() on random N-by-N puzzles

* 100 random 2-by-2 boards

```

2
0 1
3 2
priorities: 2
moves: 0
2
1 0
3 2

```


priorities: 2

moves: 1

2

1 2

3 0

priorities: 2

moves: 2

2

0 3

2 1

priorities: 6

moves: 0

2

2 3

0 1

priorities: 6

moves: 1

2

2 3

1 0

priorities: 6

moves: 2

2

2 0

1 3

priorities: 6

moves: 3

2

0 2

1 3

priorities: 6

moves: 4

2

1 2

0 3

priorities: 6

moves: 5

2

1 2

3 0

priorities: 6

moves: 6

2

3 0

2 1
priorities: 5
moves: 0
2
3 1
2 0
priorities: 5
moves: 1
2
3 1
0 2
priorities: 5
moves: 2
2
0 1
3 2
priorities: 5
moves: 3
2
1 0
3 2
priorities: 5
moves: 4
2
1 2
3 0
priorities: 5
moves: 5
2
1 2
0 3
priorities: 1
moves: 0
2
1 2
3 0
priorities: 1
moves: 1
2
3 1
0 2
priorities: 3
moves: 0
2

0 1
3 2
priorities: 3
moves: 1
2
1 0
3 2
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3
2
2 3
1 0
priorities: 4
moves: 0
2
2 0
1 3
priorities: 4
moves: 1
2
0 2
1 3
priorities: 4
moves: 2
2
1 2
0 3
priorities: 4
moves: 3
2
1 2
3 0
priorities: 4
moves: 4
2
3 1
0 2
priorities: 3
moves: 0

```
2
  0 1
  3 2
priorities: 3
moves: 1
2
  1 0
  3 2
priorities: 3
moves: 2
2
  1 2
  3 0
priorities: 3
moves: 3
2
  0 2
  1 3
priorities: 2
moves: 0
2
  1 2
  0 3
priorities: 2
moves: 1
2
  1 2
  3 0
priorities: 2
moves: 2
2
  3 1
  0 2
priorities: 3
moves: 0
2
  0 1
  3 2
priorities: 3
moves: 1
2
  1 0
  3 2
priorities: 3
```

```
moves: 2
2
 1 2
 3 0
priorities: 3
moves: 3
2
 0 1
 3 2
priorities: 2
moves: 0
2
 1 0
 3 2
priorities: 2
moves: 1
2
 1 2
 3 0
priorities: 2
moves: 2
2
 2 3
 0 1
priorities: 5
moves: 0
2
 2 3
 1 0
priorities: 5
moves: 1
2
 2 0
 1 3
priorities: 5
moves: 2
2
 0 2
 1 3
priorities: 5
moves: 3
2
 1 2
 0 3
```

priorities: 5

moves: 4

2

1 2

3 0

priorities: 5

moves: 5

2

3 1

0 2

priorities: 3

moves: 0

2

0 1

3 2

priorities: 3

moves: 1

2

1 0

3 2

priorities: 3

moves: 2

2

1 2

3 0

priorities: 3

moves: 3

2

2 3

1 0

priorities: 4

moves: 0

2

2 0

1 3

priorities: 4

moves: 1

2

0 2

1 3

priorities: 4

moves: 2

2

1 2

0 3
priorities: 4
moves: 3
2
1 2
3 0
priorities: 4
moves: 4
2
1 0
3 2
priorities: 1
moves: 0
2
1 2
3 0
priorities: 1
moves: 1
2
2 3
1 0
priorities: 4
moves: 0
2
2 0
1 3
priorities: 4
moves: 1
2
0 2
1 3
priorities: 4
moves: 2
2
1 2
0 3
priorities: 4
moves: 3
2
1 2
3 0
priorities: 4
moves: 4
2

3 1
0 2
priorities: 3
moves: 0
2
0 1
3 2
priorities: 3
moves: 1
2
1 0
3 2
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3
2
1 0
3 2
priorities: 1
moves: 0
2
1 2
3 0
priorities: 1
moves: 1
2
3 1
2 0
priorities: 4
moves: 0
2
3 1
0 2
priorities: 4
moves: 1
2
0 1
3 2
priorities: 4
moves: 2


```
2
  1  0
  3  2
priorities: 4
moves: 3
2
  1  2
  3  0
priorities: 4
moves: 4
2
  0  1
  3  2
priorities: 2
moves: 0
2
  1  0
  3  2
priorities: 2
moves: 1
2
  1  2
  3  0
priorities: 2
moves: 2
2
  0  2
  1  3
priorities: 2
moves: 0
2
  1  2
  0  3
priorities: 2
moves: 1
2
  1  2
  3  0
priorities: 2
moves: 2
2
  2  3
  0  1
priorities: 5
```

```
moves: 0
2
  2  3
  1  0
priorities: 5
moves: 1
2
  2  0
  1  3
priorities: 5
moves: 2
2
  0  2
  1  3
priorities: 5
moves: 3
2
  1  2
  0  3
priorities: 5
moves: 4
2
  1  2
  3  0
priorities: 5
moves: 5
2
  0  1
  3  2
priorities: 2
moves: 0
2
  1  0
  3  2
priorities: 2
moves: 1
2
  1  2
  3  0
priorities: 2
moves: 2
2
  2  3
  1  0
```

priorities: 4

moves: 0

2

2 0

1 3

priorities: 4

moves: 1

2

0 2

1 3

priorities: 4

moves: 2

2

1 2

0 3

priorities: 4

moves: 3

2

1 2

3 0

priorities: 4

moves: 4

2

0 1

3 2

priorities: 2

moves: 0

2

1 0

3 2

priorities: 2

moves: 1

2

1 2

3 0

priorities: 2

moves: 2

2

3 1

2 0

priorities: 4

moves: 0

2

3 1

0 2
priorities: 4
moves: 1
2
0 1
3 2
priorities: 4
moves: 2
2
1 0
3 2
priorities: 4
moves: 3
2
1 2
3 0
priorities: 4
moves: 4
2
0 1
3 2
priorities: 2
moves: 0
2
1 0
3 2
priorities: 2
moves: 1
2
1 2
3 0
priorities: 2
moves: 2
2
0 1
3 2
priorities: 2
moves: 0
2
1 0
3 2
priorities: 2
moves: 1
2

1 2
3 0
priorities: 2
moves: 2
2
2 3
1 0
priorities: 4
moves: 0
2
2 0
1 3
priorities: 4
moves: 1
2
0 2
1 3
priorities: 4
moves: 2
2
1 2
0 3
priorities: 4
moves: 3
2
1 2
3 0
priorities: 4
moves: 4
2
3 0
2 1
priorities: 5
moves: 0
2
3 1
2 0
priorities: 5
moves: 1
2
3 1
0 2
priorities: 5
moves: 2

```
2
  0 1
  3 2
priorities: 5
moves: 3
2
  1 0
  3 2
priorities: 5
moves: 4
2
  1 2
  3 0
priorities: 5
moves: 5
2
  2 3
  1 0
priorities: 4
moves: 0
2
  2 0
  1 3
priorities: 4
moves: 1
2
  0 2
  1 3
priorities: 4
moves: 2
2
  1 2
  0 3
priorities: 4
moves: 3
2
  1 2
  3 0
priorities: 4
moves: 4
2
  1 0
  3 2
priorities: 1
```

```
moves: 0
2
  1  2
  3  0
priorities: 1
moves: 1
2
  0  1
  3  2
priorities: 2
moves: 0
2
  1  0
  3  2
priorities: 2
moves: 1
2
  1  2
  3  0
priorities: 2
moves: 2
2
  2  0
  1  3
priorities: 3
moves: 0
2
  0  2
  1  3
priorities: 3
moves: 1
2
  1  2
  0  3
priorities: 3
moves: 2
2
  1  2
  3  0
priorities: 3
moves: 3
2
  0  1
  3  2
```

priorities: 2

moves: 0

2

1 0

3 2

priorities: 2

moves: 1

2

1 2

3 0

priorities: 2

moves: 2

2

2 3

1 0

priorities: 4

moves: 0

2

2 0

1 3

priorities: 4

moves: 1

2

0 2

1 3

priorities: 4

moves: 2

2

1 2

0 3

priorities: 4

moves: 3

2

1 2

3 0

priorities: 4

moves: 4

2

3 1

0 2

priorities: 3

moves: 0

2

0 1

3 2
priorities: 3
moves: 1
2
1 0
3 2
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3
2
0 1
3 2
priorities: 2
moves: 0
2
1 0
3 2
priorities: 2
moves: 1
2
1 2
3 0
priorities: 2
moves: 2
2
2 3
1 0
priorities: 4
moves: 0
2
2 0
1 3
priorities: 4
moves: 1
2
0 2
1 3
priorities: 4
moves: 2
2

1 2
0 3
priorities: 4
moves: 3
2
1 2
3 0
priorities: 4
moves: 4
2
0 2
1 3
priorities: 2
moves: 0
2
1 2
0 3
priorities: 2
moves: 1
2
1 2
3 0
priorities: 2
moves: 2
2
2 0
1 3
priorities: 3
moves: 0
2
0 2
1 3
priorities: 3
moves: 1
2
1 2
0 3
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3

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2
 3 0
2 1
priorities: 5
moves: 0
2
 3 1
 2 0
priorities: 5
moves: 1
2
 3 1
 0 2
priorities: 5
moves: 2
2
 0 1
 3 2
priorities: 5
moves: 3
2
 1 0
 3 2
priorities: 5
moves: 4
2
 1 2
 3 0
priorities: 5
moves: 5
2
 2 3
 0 1
priorities: 5
moves: 0
2
 2 3
 1 0
priorities: 5
moves: 1
2
 2 0
 1 3
priorities: 5
```

moves: 2
2
0 2
1 3
priorities: 5
moves: 3
2
1 2
0 3
priorities: 5
moves: 4
2
1 2
3 0
priorities: 5
moves: 5
2
2 3
0 1
priorities: 5
moves: 0
2
2 3
1 0
priorities: 5
moves: 1
2
2 0
1 3
priorities: 5
moves: 2
2
0 2
1 3
priorities: 5
moves: 3
2
1 2
0 3
priorities: 5
moves: 4
2
1 2
3 0

priorities: 5

moves: 5

2

0 2

1 3

priorities: 2

moves: 0

2

1 2

0 3

priorities: 2

moves: 1

2

1 2

3 0

priorities: 2

moves: 2

2

3 0

2 1

priorities: 5

moves: 0

2

3 1

2 0

priorities: 5

moves: 1

2

3 1

0 2

priorities: 5

moves: 2

2

0 1

3 2

priorities: 5

moves: 3

2

1 0

3 2

priorities: 5

moves: 4

2

1 2

3 0
priorities: 5
moves: 5
2
0 2
1 3
priorities: 2
moves: 0
2
1 2
0 3
priorities: 2
moves: 1
2
1 2
3 0
priorities: 2
moves: 2
2
3 1
0 2
priorities: 3
moves: 0
2
0 1
3 2
priorities: 3
moves: 1
2
1 0
3 2
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3
2
3 1
0 2
priorities: 3
moves: 0
2

0 1
3 2
priorities: 3
moves: 1
2
1 0
3 2
priorities: 3
moves: 2
2
1 2
3 0
priorities: 3
moves: 3
2
0 2
1 3
priorities: 2
moves: 0
2
1 2
0 3
priorities: 2
moves: 1
2
1 2
3 0
priorities: 2
moves: 2
2
0 1
3 2
priorities: 2
moves: 0
2
1 0
3 2
priorities: 2
moves: 1
2
1 2
3 0
priorities: 2
moves: 2

```
2
 0 2
 1 3
priorities: 2
moves: 0
2
 1 2
 0 3
priorities: 2
moves: 1
2
 1 2
 3 0
priorities: 2
moves: 2
2
 2 3
 1 0
priorities: 4
moves: 0
2
 2 0
 1 3
priorities: 4
moves: 1
2
 0 2
 1 3
priorities: 4
moves: 2
2
 1 2
 0 3
priorities: 4
moves: 3
2
 1 2
 3 0
priorities: 4
moves: 4
2
 1 0
 3 2
priorities: 1
```



```

moves: 0
2
  1  2
  3  0
priorities: 1
moves: 1
2
  3  1
  0  2
priorities: 3
moves: 0
2
  0  1
  3  2
priorities: 3
moves: 1
2
  1  0
  3  2
priorities: 3
moves: 2
2
  1  2
  3  0
priorities: 3
moves: 3
Total: 0/20 tests passed: Could not complete tests in allotted
time, which results in a reported score of 0.

```

```

=====

*****
*****
*   memory
*****
*****

```

Computing memory of Board

*-----

Running 8 total tests.

Memory usage of an N-by-N board

N	student (bytes)	reference (bytes)
---	-----------------	-------------------

```

=> FAILED      4          264          240
=> FAILED      8          584          560
=> FAILED     12         1032         1008
=> FAILED     16         1608         1584
=> FAILED     20         2312         2288
=> FAILED     36         6408         6384
=> FAILED     72        23112        23088
=> passed    120        61512        61488
==> 1/8 tests passed

```

Total: 1/8 tests passed!

Student memory = 4.00 N² + 32.00 N + 72.00 (R² = 1.000)
Reference memory = 4.00 N² + 32.00 N + 48.00 (R² = 1.000)

=====

```

*****
*****
*   timing
*****
*****

```

Timing Solver

*-----

Running 17 total tests.

Timing tests use your implementation of Board.java and Solver.java.
Maximum time allowed per puzzle is 10 seconds.

```

          filename  N    seconds  insert()      delMi
n()          max PQ size
-----
-----
3
 1  6  4
 7  0  8
 2  3  5
priorities: 16
moves: 0
3
 1  0  4

```

7 6 8
2 3 5
priorities: 16
moves: 1
3
1 4 0
7 6 8
2 3 5
priorities: 16
moves: 2
3
1 6 4
7 3 8
2 0 5
priorities: 16
moves: 1
3
1 6 4
7 3 8
0 2 5
priorities: 16
moves: 2
3
1 6 4
0 3 8
7 2 5
priorities: 16
moves: 3
3
1 6 4
7 3 8
2 5 0
priorities: 16
moves: 2
3
1 6 4
7 3 0
2 5 8
priorities: 16
moves: 3
3
1 6 0
7 3 4
2 5 8

priorities: 16

moves: 4

3

1 0 6

7 3 4

2 5 8

priorities: 16

moves: 5

3

1 3 6

7 0 4

2 5 8

priorities: 16

moves: 6

3

1 3 6

7 5 4

2 0 8

priorities: 16

moves: 7

3

1 3 6

7 5 4

0 2 8

priorities: 16

moves: 8

3

1 3 6

0 5 4

7 2 8

priorities: 16

moves: 9

3

1 3 6

7 5 4

2 8 0

priorities: 16

moves: 8

3

1 3 6

7 4 0

2 5 8

priorities: 16

moves: 7

3
1 3 0
7 4 6
2 5 8
priorities: 16
moves: 8

3
1 0 3
7 4 6
2 5 8
priorities: 16
moves: 9

3
1 6 4
7 0 3
2 5 8
priorities: 16
moves: 4

3
1 0 4
7 6 3
2 5 8
priorities: 16
moves: 5

3
1 4 0
7 6 3
2 5 8
priorities: 16
moves: 6

3
1 4 3
7 6 0
2 5 8
priorities: 16
moves: 7

3
1 4 3
7 0 6
2 5 8
priorities: 16
moves: 8

3
1 0 3

7 4 6

2 5 8

priorities: 16

moves: 9

3

1 4 3

7 5 6

2 0 8

priorities: 16

moves: 9

3

1 4 3

7 5 6

0 2 8

priorities: 16

moves: 10

3

1 4 3

0 5 6

7 2 8

priorities: 16

moves: 11

3

1 4 3

7 5 6

2 8 0

priorities: 16

moves: 10

3

1 6 4

7 5 3

2 0 8

priorities: 16

moves: 5

3

1 6 4

7 5 3

0 2 8

priorities: 16

moves: 6

3

1 6 4

0 5 3

7 2 8

priorities: 16

moves: 7

3

1 6 4

7 5 3

2 8 0

priorities: 16

moves: 6

3

1 6 4

7 8 0

2 3 5

priorities: 16

moves: 1

3

1 6 0

7 8 4

2 3 5

priorities: 16

moves: 2

3

1 0 6

7 8 4

2 3 5

priorities: 16

moves: 3

3

1 6 4

7 8 5

2 3 0

priorities: 16

moves: 2

3

1 6 4

7 8 5

2 0 3

priorities: 16

moves: 3

3

1 6 4

7 0 5

2 8 3

priorities: 16

moves: 4

3
1 0 4
7 6 5
2 8 3
priorities: 16
moves: 5

3
1 4 0
7 6 5
2 8 3
priorities: 16
moves: 6

3
1 6 4
7 5 0
2 8 3
priorities: 16
moves: 5

3
1 6 0
7 5 4
2 8 3
priorities: 16
moves: 6

3
1 0 6
7 5 4
2 8 3
priorities: 16
moves: 7

3
1 6 4
7 5 3
2 8 0
priorities: 16
moves: 6

3
1 6 4
7 8 5
0 2 3
priorities: 16
moves: 4

3
1 6 4

0 8 5

7 2 3

priorities: 16

moves: 5

3

1 4 3

5 0 6

7 2 8

priorities: 18

moves: 12

3

1 0 3

5 4 6

7 2 8

priorities: 18

moves: 13

3

1 4 3

5 2 6

7 0 8

priorities: 18

moves: 13

3

1 4 3

5 2 6

7 8 0

priorities: 18

moves: 14

3

0 4 3

1 5 6

7 2 8

priorities: 18

moves: 12

3

4 0 3

1 5 6

7 2 8

priorities: 18

moves: 13

3

1 4 3

7 5 0

2 8 6

priorities: 18

moves: 11

3

1 3 6

5 0 4

7 2 8

priorities: 18

moves: 10

3

1 3 6

5 2 4

7 0 8

priorities: 18

moves: 11

3

1 3 6

5 2 4

7 8 0

priorities: 18

moves: 12

3

1 3 6

5 4 0

7 2 8

priorities: 18

moves: 11

3

1 3 0

5 4 6

7 2 8

priorities: 18

moves: 12

3

1 0 3

5 4 6

7 2 8

priorities: 18

moves: 13

3

1 3 0

7 4 6

2 5 8

priorities: 18

moves: 10

3
0 1 3
7 4 6
2 5 8
priorities: 18
moves: 10

3
0 3 6
1 5 4
7 2 8
priorities: 18
moves: 10

3
1 4 3
7 0 6
2 5 8
priorities: 18
moves: 10

3
1 4 3
7 5 6
2 0 8
priorities: 18
moves: 11

3
1 4 3
7 5 6
0 2 8
priorities: 18
moves: 12

3
1 4 3
0 5 6
7 2 8
priorities: 18
moves: 13

3
1 4 3
7 5 6
2 8 0
priorities: 18
moves: 12

3
0 1 3

7 4 6
2 5 8
priorities: 18
moves: 10
3
1 4 3
0 7 6
2 5 8
priorities: 18
moves: 9
3
1 4 3
2 7 6
0 5 8
priorities: 18
moves: 10
3
1 3 6
7 5 0
2 8 4
priorities: 18
moves: 9
3
1 3 0
7 5 6
2 8 4
priorities: 18
moves: 10
3
1 0 3
7 5 6
2 8 4
priorities: 18
moves: 11
3
0 1 6
7 5 4
2 8 3
priorities: 18
moves: 8
3
1 4 3
7 6 8
2 5 0

priorities: 18

moves: 8

3

1 5 6

7 0 4

2 8 3

priorities: 18

moves: 8

3

1 5 6

7 4 0

2 8 3

priorities: 18

moves: 9

3

1 5 0

7 4 6

2 8 3

priorities: 18

moves: 10

3

1 5 6

7 4 3

2 8 0

priorities: 18

moves: 10

3

0 6 4

1 5 3

7 2 8

priorities: 18

moves: 8

3

1 6 4

5 0 3

7 2 8

priorities: 18

moves: 8

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1 0 4

5 6 3

7 2 8

priorities: 18

moves: 9

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1 4 0
5 6 3
7 2 8
priorities: 18
moves: 10

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1 4 3
5 6 0
7 2 8
priorities: 18
moves: 11

3
1 4 3
5 0 6
7 2 8
priorities: 18
moves: 12

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5 4 6
7 2 8
priorities: 18
moves: 13

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1 4 3
5 2 6
7 0 8
priorities: 18
moves: 13

3
1 4 3
5 2 6
7 8 0
priorities: 18
moves: 14

3
1 4 3
0 5 6
7 2 8
priorities: 18
moves: 13

3
1 6 4

5 2 3

7 0 8

priorities: 18

moves: 9

3

1 6 4

5 2 3

7 8 0

priorities: 18

moves: 10

3

1 3 6

7 4 8

2 5 0

priorities: 18

moves: 8

3

1 3 6

0 7 4

2 5 8

priorities: 18

moves: 7

3

1 3 6

2 7 4

0 5 8

priorities: 18

moves: 8

3

1 4 5

7 6 0

2 8 3

priorities: 18

moves: 7

3

1 4 5

7 6 3

2 8 0

priorities: 18

moves: 8

3

1 4 5

7 0 6

2 8 3

priorities: 18

moves: 8

3

1 0 5

7 4 6

2 8 3

priorities: 18

moves: 9

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1 5 0

7 4 6

2 8 3

priorities: 18

moves: 10

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1 6 4

7 5 0

2 8 3

priorities: 18

moves: 7

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1 6 0

7 5 4

2 8 3

priorities: 18

moves: 8

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1 0 6

7 5 4

2 8 3

priorities: 18

moves: 9

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1 6 4

7 5 3

2 0 8

priorities: 18

moves: 7

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1 6 4

7 5 3

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priorities: 18

moves: 8

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1 6 4
0 5 3
7 2 8
priorities: 18
moves: 9

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7 3 4
2 5 8
priorities: 18
moves: 6

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1 8 5
7 2 3
priorities: 18
moves: 6

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7 6 3
2 5 8
priorities: 18
moves: 6

3
1 6 4
8 0 5
7 2 3
priorities: 18
moves: 6

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8 6 5
7 2 3
priorities: 18
moves: 7

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1 4 0
8 6 5
7 2 3
priorities: 18
moves: 8

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1 6 4

8 2 5

7 0 3

priorities: 18

moves: 7

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1 6 4

8 5 0

7 2 3

priorities: 18

moves: 7

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1 6 0

8 5 4

7 2 3

priorities: 18

moves: 8

3

1 0 6

8 5 4

7 2 3

priorities: 18

moves: 9

3

1 6 4

8 5 3

7 2 0

priorities: 18

moves: 8

3

0 1 4

7 6 5

2 8 3

priorities: 18

moves: 6

3

1 6 4

0 7 3

2 5 8

priorities: 18

moves: 5

3

1 6 4

2 7 3

0 5 8

priorities: 18

moves: 6

3

1 6 4

0 7 5

2 8 3

priorities: 18

moves: 5

3

1 6 4

2 7 5

0 8 3

priorities: 18

moves: 6

3

1 6 4

3 0 8

7 2 5

priorities: 18

moves: 4

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1 0 4

3 6 8

7 2 5

priorities: 18

moves: 5

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1 4 0

3 6 8

7 2 5

priorities: 18

moves: 6

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3 2 8

7 0 5

priorities: 18

moves: 5

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3 2 8

7 5 0

priorities: 18

moves: 6

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3 2 0
7 5 8
priorities: 18
moves: 7

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3 2 4
7 5 8
priorities: 18
moves: 8

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3 2 4
7 5 8
priorities: 18
moves: 9

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3 0 4
7 5 8
priorities: 18
moves: 10

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3 5 4
7 0 8
priorities: 18
moves: 11

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3 5 4
7 8 0
priorities: 18
moves: 12

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7 5 8
priorities: 18
moves: 11

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1 2 6

3 4 0
7 5 8
priorities: 18
moves: 11
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3 4 6
7 5 8
priorities: 18
moves: 12
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1 6 4
3 8 0
7 2 5
priorities: 18
moves: 5
3
1 6 0
3 8 4
7 2 5
priorities: 18
moves: 6
3
1 0 6
3 8 4
7 2 5
priorities: 18
moves: 7
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1 6 4
3 8 5
7 2 0
priorities: 18
moves: 6
3
0 6 4
1 3 8
7 2 5
priorities: 18
moves: 4
3
1 8 6
7 0 4
2 3 5

priorities: 18

moves: 4

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1 8 6

7 3 4

2 0 5

priorities: 18

moves: 5

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1 8 6

7 3 4

0 2 5

priorities: 18

moves: 6

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1 8 6

0 3 4

7 2 5

priorities: 18

moves: 7

3

1 8 6

7 3 4

2 5 0

priorities: 18

moves: 6

3

1 8 6

7 4 0

2 3 5

priorities: 18

moves: 5

3

1 8 0

7 4 6

2 3 5

priorities: 18

moves: 6

3

1 8 6

7 4 5

2 3 0

priorities: 18

moves: 6

3
1 8 6
7 4 5
2 0 3
priorities: 18
moves: 7

3
1 8 6
7 4 5
0 2 3
priorities: 18
moves: 8

3
1 8 6
0 4 5
7 2 3
priorities: 18
moves: 9

3
1 8 6
4 0 5
7 2 3
priorities: 18
moves: 10

3
1 0 6
4 8 5
7 2 3
priorities: 18
moves: 11

3
1 8 6
4 2 5
7 0 3
priorities: 18
moves: 11

3
1 8 6
4 5 0
7 2 3
priorities: 18
moves: 11

3
1 8 0

4 5 6
7 2 3
priorities: 18
moves: 12
3
1 8 6
4 5 3
7 2 0
priorities: 18
moves: 12
3
0 1 6
7 8 4
2 3 5
priorities: 18
moves: 4
3
1 4 8
7 6 0
2 3 5
priorities: 18
moves: 3
3
1 4 8
7 6 5
2 3 0
priorities: 18
moves: 4
3
1 4 8
7 6 5
2 0 3
priorities: 18
moves: 5
3
1 4 8
7 6 5
0 2 3
priorities: 18
moves: 6
3
1 4 8
0 6 5
7 2 3

priorities: 18

moves: 7

3

1 4 8

7 0 6

2 3 5

priorities: 18

moves: 4

3

1 0 8

7 4 6

2 3 5

priorities: 18

moves: 5

3

1 8 0

7 4 6

2 3 5

priorities: 18

moves: 6

3

1 4 8

7 3 6

2 0 5

priorities: 18

moves: 5

3

1 4 8

7 3 6

0 2 5

priorities: 18

moves: 6

3

1 4 8

0 3 6

7 2 5

priorities: 18

moves: 7

3

1 4 8

7 3 6

2 5 0

priorities: 18

moves: 6

3
0 1 4
7 6 8
2 3 5
priorities: 18
moves: 2

3
1 6 4
0 7 8
2 3 5
priorities: 18
moves: 1

3
1 6 4
2 7 8
0 3 5
priorities: 18
moves: 2

3
1 4 3
5 2 0
7 8 6
priorities: 20
moves: 15

3
1 4 3
5 2 0
7 8 6
priorities: 20
moves: 15

3
0 4 3
1 5 6
7 2 8
priorities: 20
moves: 14

3
4 0 3
1 5 6
7 2 8
priorities: 20
moves: 15

3
0 1 3

5 4 6
7 2 8
priorities: 20
moves: 14
3

1 4 3
5 2 6
0 7 8
priorities: 20
moves: 14

3
4 5 3
1 0 6
7 2 8
priorities: 20
moves: 14

3
4 5 3
1 2 6
7 0 8
priorities: 20
moves: 15

3
4 5 3
1 2 6
7 8 0
priorities: 20
moves: 16

3
1 4 3
5 0 6
7 2 8
priorities: 20
moves: 14

3
1 4 3
5 2 6
7 0 8
priorities: 20
moves: 15

3
1 4 3
5 2 6
7 8 0

priorities: 20

moves: 16

3

1 4 3

0 5 6

7 2 8

priorities: 20

moves: 15

3

1 4 3

5 2 6

0 7 8

priorities: 20

moves: 14

3

4 3 0

1 5 6

7 2 8

priorities: 20

moves: 14

3

1 4 3

7 5 6

0 2 8

priorities: 20

moves: 14

3

1 3 0

5 4 6

7 2 8

priorities: 20

moves: 14

3

0 4 3

1 5 6

7 2 8

priorities: 20

moves: 14

3

4 0 3

1 5 6

7 2 8

priorities: 20

moves: 15

3
1 3 0
5 4 6
7 2 8
priorities: 20
moves: 14

3
1 4 3
5 0 6
7 2 8
priorities: 20
moves: 14

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4 2 5

0 3 7

1 8 6

priorities: 20

moves: 9

3
0 2 5
4 3 7
1 8 6
priorities: 20
moves: 10

3
4 2 5
1 3 7
0 8 6
priorities: 20
moves: 10

3
4 2 5
3 7 0
1 8 6
priorities: 20
moves: 9

3
4 2 0
3 7 5
1 8 6
priorities: 20
moves: 10

3
4 2 5
3 7 6
1 8 0
priorities: 20
moves: 10

3
4 8 2
1 0 5
6 3 7
priorities: 20
moves: 6

3
4 0 2
1 8 5
6 3 7
priorities: 20
moves: 7

3
4 2 0

1 8 5

6 3 7

priorities: 20

moves: 8

3

4 8 2

1 5 0

6 3 7

priorities: 20

moves: 7

3

4 2 5

3 0 8

1 6 7

priorities: 20

moves: 6

3

4 2 5

3 6 8

1 0 7

priorities: 20

moves: 7

3

4 2 5

3 6 8

1 7 0

priorities: 20

moves: 8

3

4 2 5

3 6 0

1 7 8

priorities: 20

moves: 9

3

4 2 0

3 6 5

1 7 8

priorities: 20

moves: 10

3

4 2 5

3 0 6

1 7 8

priorities: 20

moves: 10

3

4 2 5

0 3 6

1 7 8

priorities: 20

moves: 11

3

0 2 5

4 3 6

1 7 8

priorities: 20

moves: 12

3

4 2 5

1 3 6

0 7 8

priorities: 20

moves: 12

3

4 2 5

1 3 6

7 0 8

priorities: 20

moves: 13

3

4 2 5

1 3 6

7 8 0

priorities: 20

moves: 14

3

4 2 5

0 3 8

1 6 7

priorities: 20

moves: 7

3

0 2 5

4 3 8

1 6 7

priorities: 20

moves: 8

3
4 2 5
1 3 8
0 6 7
priorities: 20
moves: 8

3
4 8 2
0 7 6
3 1 5
priorities: 20
moves: 5

3
0 8 2
4 7 6
3 1 5
priorities: 20
moves: 6

3
4 8 2
7 0 6
3 1 5
priorities: 20
moves: 6

3
4 0 2
7 8 6
3 1 5
priorities: 20
moves: 7

3
4 2 0
7 8 6
3 1 5
priorities: 20
moves: 8

3
4 8 2
7 1 6
3 0 5
priorities: 20
moves: 7

3
4 8 2

7 1 6
0 3 5
priorities: 20
moves: 8
3

4 8 2
0 1 6
7 3 5
priorities: 20
moves: 9

3
0 8 2
4 1 6
7 3 5
priorities: 20
moves: 10

3
4 8 2
1 0 6
7 3 5
priorities: 20
moves: 10

3
4 0 2
1 8 6
7 3 5
priorities: 20
moves: 11

3
4 2 0
1 8 6
7 3 5
priorities: 20
moves: 12

3
4 8 2
1 3 6
7 0 5
priorities: 20
moves: 11

3
4 8 2
1 3 6
7 5 0

priorities: 20

moves: 12

3

4 8 2

7 1 6

3 5 0

priorities: 20

moves: 8

3

4 0 8

3 5 2

1 6 7

priorities: 20

moves: 5

3

8 0 2

4 6 5

3 1 7

priorities: 20

moves: 5

3

8 2 0

4 6 5

3 1 7

priorities: 20

moves: 6

3

4 8 2

6 0 5

3 1 7

priorities: 20

moves: 4

3

4 0 2

6 8 5

3 1 7

priorities: 20

moves: 5

3

4 2 0

6 8 5

3 1 7

priorities: 20

moves: 6

3
4 8 2
6 1 5
3 0 7
priorities: 20
moves: 5

3
4 8 2
6 1 5
0 3 7
priorities: 20
moves: 6

3
4 8 2
6 1 5
3 7 0
priorities: 20
moves: 6

3
4 8 2
6 5 0
3 1 7
priorities: 20
moves: 5

3
0 4 8
3 6 2
1 7 5
priorities: 20
moves: 4

3
3 4 8
0 6 2
1 7 5
priorities: 20
moves: 5

3
3 4 8
1 6 2
0 7 5
priorities: 20
moves: 6

3
3 4 8

1 6 2

7 0 5

priorities: 20

moves: 7

3

3 4 8

1 6 2

7 5 0

priorities: 20

moves: 8

3

4 6 8

3 0 2

1 7 5

priorities: 20

moves: 4

3

4 6 8

0 3 2

1 7 5

priorities: 20

moves: 5

3

0 6 8

4 3 2

1 7 5

priorities: 20

moves: 6

3

4 6 8

1 3 2

0 7 5

priorities: 20

moves: 6

3

4 6 8

1 3 2

7 0 5

priorities: 20

moves: 7

3

4 6 8

1 3 2

7 5 0

priorities: 20

moves: 8

3

4 6 8

3 2 0

1 7 5

priorities: 20

moves: 5

3

4 6 0

3 2 8

1 7 5

priorities: 20

moves: 6

3

4 0 6

3 2 8

1 7 5

priorities: 20

moves: 7

3

4 2 6

3 0 8

1 7 5

priorities: 20

moves: 8

3

4 2 6

0 3 8

1 7 5

priorities: 20

moves: 9

3

0 2 6

4 3 8

1 7 5

priorities: 20

moves: 10

3

4 2 6

1 3 8

0 7 5

priorities: 20

moves: 10

3
4 2 6
1 3 8
7 0 5
priorities: 20
moves: 11

3
4 2 6
1 3 8
7 5 0
priorities: 20
moves: 12

3
4 2 6
1 3 0
7 5 8
priorities: 20
moves: 13

3
4 2 0
1 3 6
7 5 8
priorities: 20
moves: 14

3
4 2 6
1 0 3
7 5 8
priorities: 20
moves: 14

3
4 2 6
1 5 3
7 0 8
priorities: 20
moves: 15

3
4 2 6
1 5 3
7 8 0
priorities: 20
moves: 16

3
4 2 6

3 8 0
1 7 5
priorities: 20
moves: 9
3
4 2 0
3 8 6
1 7 5
priorities: 20
moves: 10
3
4 2 6
3 8 5
1 7 0
priorities: 20
moves: 10
3
4 6 8
3 2 5
1 7 0
priorities: 20
moves: 6
3
4 2 3
0 5 6
1 8 7
priorities: 22
moves: 17
3
4 2 3
1 5 6
0 8 7
priorities: 22
moves: 18
3
1 2 6
4 3 0
7 8 5
priorities: 22
moves: 17
3
1 2 6
4 3 5
7 8 0

priorities: 22

moves: 18

3

1 2 6

4 0 3

7 8 5

priorities: 22

moves: 18

3

4 2 6

1 5 0

7 8 3

priorities: 22

moves: 17

3

4 2 0

1 5 6

7 8 3

priorities: 22

moves: 18

3

4 0 2

1 5 6

7 8 3

priorities: 22

moves: 17

3

4 2 6

1 5 0

7 8 3

priorities: 22

moves: 17

3

4 2 0

1 5 6

7 8 3

priorities: 22

moves: 18

3

4 0 2

1 5 6

7 8 3

priorities: 22

moves: 17

3
1 2 3
8 4 6
7 0 5
priorities: 22
moves: 17

3
1 3 2
4 8 6
7 0 5
priorities: 22
moves: 17

3
1 3 2
4 0 6
7 8 5
priorities: 22
moves: 18

3
1 3 2
4 6 0
7 8 5
priorities: 22
moves: 17

3
1 3 2
4 6 5
7 8 0
priorities: 22
moves: 18

3
1 3 2
4 8 6
7 0 5
priorities: 22
moves: 17

3
1 3 2
4 8 6
7 5 0
priorities: 22
moves: 18

3
1 3 2

0 4 6

7 8 5

priorities: 22

moves: 17

3

4 2 6

1 5 3

7 0 8

priorities: 22

moves: 17

3

1 2 6

0 4 3

7 8 5

priorities: 22

moves: 17

3

4 2 3

1 8 6

7 0 5

priorities: 22

moves: 17

3

4 2 3

1 0 6

7 8 5

priorities: 22

moves: 18

3

1 2 6

4 8 3

7 0 5

priorities: 22

moves: 17

3

1 2 6

4 8 3

7 5 0

priorities: 22

moves: 18

3

1 0 6

4 2 3

7 8 5

priorities: 22

moves: 17

3

1 2 6

4 3 5

7 0 8

priorities: 22

moves: 17

3

4 3 2

1 5 0

7 8 6

priorities: 22

moves: 17

3

2 0 3

4 1 6

7 8 5

priorities: 22

moves: 17

3

2 1 3

4 0 6

7 8 5

priorities: 22

moves: 18

3

4 2 3

1 6 5

7 0 8

priorities: 22

moves: 17

3

4 2 0

1 5 3

7 6 8

priorities: 22

moves: 16

3

4 3 0

1 2 6

7 8 5

priorities: 22

moves: 16

3
4 2 6
1 5 3
0 7 8
priorities: 22
moves: 16

3
0 4 2
1 5 6
7 8 3
priorities: 22
moves: 16

3
1 4 2
0 5 6
7 8 3
priorities: 22
moves: 17

3
0 1 3
4 6 2
7 8 5
priorities: 22
moves: 16

3
1 3 2
4 6 5
0 7 8
priorities: 22
moves: 16

3
4 2 6
1 5 3
0 7 8
priorities: 22
moves: 16

3
4 2 3
1 0 5
7 6 8
priorities: 22
moves: 16

3
4 2 3

```
1 6 5
7 0 8
priorities: 22
moves: 17
3
4 2 3
1 6 5
7 8 0
```

```
priorities: 22
moves: 18
3
2 5 3
4 0 6
1 8 7
```

```
priorities: 22
moves: 16
3
1 3 2
4 5 8
7 6 0
```

```
priorities: 22
moves: 16
3
1 3 2
4 5 0
7 6
```

Total: 0/17 tests passed: **Could not complete tests in allotted time, which results in a reported score of 0.**

=====

Submission

Submission time Fri-02-Oct 21:19:29

Raw Score 64.17 / 100.00

Feedback See the [Assessment Guide](#) for information on how to interpret this report.

Assessment Summary

Compilation: PASSED
Style: PASSED
Findbugs: Potential bugs found.
API: PASSED

Correctness: 35/42 tests passed
Memory: 8/8 tests passed
Timing: 0/17 tests passed

Aggregate score: 64.17% [Correctness: 65%, Memory: 10%, Timing: 25%, Style: 0%]

Assessment Details

The following files were submitted:

total 20K
-rw-r--r-- 1 4.7K Oct 3 04:19 Board.java
-rw-r--r-- 1 5.1K Oct 3 04:19 Solver.java
-rw-r--r-- 1 3.1K Oct 3 04:19 studentSubmission.zip

* compiling

% javac Board.java
*-----

=====

% javac Solver.java
*-----

Note: Solver.java uses unchecked or unsafe operations.
Note: Recompile with -Xlint:unchecked for details.

=====

```
% checkstyle *.java
```

```
*-----
```

```
=====
```

```
% findbugs *.class
```

```
*-----
```

```
H C EC_UNRELATED_TYPES EC: Call to Board.equals(Solver$Node) in new  
Solver(Board) At Solver.java:[line 87]
```

```
Warnings generated: 1
```

```
=====
```

```
Testing the APIs of your programs.
```

```
*-----
```

```
Board:
```

```
Solver:
```

```
=====
```

```
*****
```

```
*****
```

```
* correctness
```

```
*****
```

```
*****
```

```
Testing methods in Board
```

```
*-----
```

```
Running 22 total tests.
```

```
Tests 5, 6, 13, and 14 rely upon toString() returning results in pr  
escribed format.
```

```
Test 1a: Test hamming() with file inputs
```

```
* puzzle04.txt
```

```
* puzzle00.txt
```

```
* puzzle07.txt
```

```
* puzzle17.txt
```

```
* puzzle27.txt
```

```
* puzzle2x2-unsolvable1.txt
```

Test 1b: Test hamming() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 2a: Test manhattan() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle07.txt
- * puzzle17.txt
- * puzzle27.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 2b: Test manhattan() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 3: Test dimension() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5

==> passed

Test 4a: Test toString() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 4b: Test toString() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 5a: Test neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 5b: Test neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 6a: Test neighbors() of neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 6b: Test neighbors() of neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4

- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 7a: Test twin() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 7b: Test twin() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 8a: Test isGoal() on file inputs

- * puzzle00.txt
- * puzzle04.txt
- * puzzle16.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt
- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-00.txt
- * puzzle4x4-00.txt

==> passed

Test 8b: Test isGoal() on N-by-N goal boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 6-by-6
- * 100-by-100

==> passed

Test 9: Check whether two Board objects can be created at the same time

- * random 3-by-3 and 3-by-3 boards
- * random 4-by-4 and 4-by-4 boards
- * random 2-by-2 and 2-by-2 boards
- * random 3-by-3 and 4-by-4 boards
- * random 4-by-4 and 3-by-3 boards

==> passed

Test 10a: Check equals()

- * reflexive
- * symmetric
- * checks that individual entries of array are equal
- * argument is object of type String
- * argument is object of type Object
- * argument is null
- * argument is Board of different dimension

==> passed

Test 10b: Test equals() on M-by-M vs. N-by-N goal boards

- * M = 2, N = 2
- * M = 3, N = 3
- * M = 4, N = 4
- * M = 2, N = 5
- * M = 5, N = 2

==> passed

Test 11: Check that Board is immutable by changing argument array after

construction and making sure Board does not mutate

==> passed

Test 12: Check that Board is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle10.txt
- * puzzle20.txt
- * puzzle30.txt
- * 2-by-2
- * 3-by-3
- * 4-by-4

==> passed

Test 13: Call hamming() on a board that is kth-neighbor of a board


```
* 0th neighbor of puzzle27.txt
* 1th neighbor of puzzle27.txt
* 2th neighbor of puzzle27.txt
* 13th neighbor of puzzle27.txt
* 13th neighbor of puzzle00.txt
* 13th neighbor of puzzle2x2-unsolvable1.txt
==> passed
```

Test 14: Call manhattan() on a board that is a kth-neighbor of a board

```
* 0th neighbor of puzzle27.txt
* 1th neighbor of puzzle27.txt
* 2th neighbor of puzzle27.txt
* 13th neighbor of puzzle27.txt
* 13th neighbor of puzzle00.txt
* 13th neighbor of puzzle2x2-unsolvable1.txt
==> passed
```

Total: 22/22 tests passed!

```
=====

*****
*****
*   correctness (substituting reference Board.java)
*****
*****
```

Testing methods in Solver

*-----

Running 20 total tests.

Test 1: Call moves() with file inputs

```
* puzzle00.txt
* puzzle01.txt
* puzzle02.txt
* puzzle03.txt
* puzzle04.txt
* puzzle05.txt
* puzzle06.txt
* puzzle07.txt
* puzzle08.txt
* puzzle09.txt
```

- * puzzle10.txt
- * puzzle11.txt
- * puzzle12.txt
- * puzzle13.txt

==> passed

Test 2: Call solution() with file inputs

- * puzzle00.txt
- * puzzle01.txt
- * puzzle02.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle05.txt
- * puzzle06.txt
- * puzzle07.txt
- * puzzle08.txt
- * puzzle10.txt
- * puzzle15.txt

==> passed

Test 3: Create two Solver objects at the same time

- * puzzle04.txt and puzzle04.txt
- * puzzle00.txt and puzzle04.txt
- * puzzle04.txt and puzzle00.txt

==> passed

Test 4a: Call isSolvable() with file inputs

- * puzzle01.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle17.txt
- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-unsolvable2.txt
- * puzzle4x4-unsolvable.txt

==> passed

Test 4b: Call isSolvable() on random N-by-N puzzles

- * 100 random 2-by-2 boards

==> passed

Test 5: Call moves() on unsolvable puzzles

- * puzzle2x2-unsolvable1.txt
- * puzzle2x2-unsolvable2.txt
- * puzzle3x3-unsolvable1.txt

```
* puzzle3x3-unsolvable2.txt
* puzzle4x4-unsolvable.txt
==> passed
```

Test 6: Call solution() on unsolvable puzzles

```
* puzzle2x2-unsolvable1.txt
* puzzle2x2-unsolvable2.txt
* puzzle3x3-unsolvable1.txt
* puzzle3x3-unsolvable2.txt
* puzzle4x4-unsolvable.txt
==> passed
```

Test 7a: Check that Solver is immutable by testing whether methods return the same value, regardless of order in which called

```
* puzzle3x3-00.txt
* puzzle3x3-01.txt
* puzzle3x3-05.txt
* puzzle3x3-10.txt
* random 2-by-2 solvable boards
==> passed
```

Test 7b: Check that Solver is immutable by testing whether methods return the same value, regardless of order in which called

```
* puzzle3x3-unsolvable1.txt
* puzzle3x3-unsolvable2.txt
* puzzle4x4-unsolvable.txt
* random 2-by-2 unsolvable boards
==> passed
```

Test 8: Call moves() with more file inputs

```
* puzzle14.txt
* puzzle15.txt
* puzzle16.txt
* puzzle17.txt
* puzzle18.txt
* puzzle19.txt
* puzzle20.txt
* puzzle21.txt
* puzzle22.txt
* puzzle23.txt
* puzzle24.txt
* puzzle25.txt
    edu.princeton.cs.algs4.OperationCountLimitExceededException: N
umber of calls to methods in Board exceeds limit: 100000000
```

==> **FAILED**

Test 9: Check whether equals() method in Board is called with an argument of the wrong type

- * puzzle00.txt
- * puzzle05.txt
 - detected call to equals() method in Board with an argument that is not of type Board
 - likely a bug in the critical optimization
- * puzzle10.txt
 - detected call to equals() method in Board with an argument that is not of type Board
 - likely a bug in the critical optimization
- * puzzle15.txt
 - detected call to equals() method in Board with an argument that is not of type Board
 - likely a bug in the critical optimization

==> **FAILED**

Test 10: Check that constructor throws exception if board is null

==> passed

Test 11: Check for fragile dependence on toString()

- * puzzle00.txt
- * puzzle04.txt
- * puzzle08.txt
- * puzzle12.txt

==> passed

Test 12a: Call moves() with 2-by-2 file inputs

- * puzzle2x2-00.txt
- * puzzle2x2-01.txt
- * puzzle2x2-02.txt
- * puzzle2x2-03.txt
- * puzzle2x2-04.txt
- * puzzle2x2-05.txt
- * puzzle2x2-06.txt

==> passed

Test 12b: Call solution() with 2-by-2 file inputs

- * puzzle2x2-00.txt
- * puzzle2x2-01.txt
- * puzzle2x2-02.txt

- * puzzle2x2-03.txt
- * puzzle2x2-04.txt
- * puzzle2x2-05.txt
- * puzzle2x2-06.txt

==> passed

Test 13a: Call moves() with 3-by-3 file inputs

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-02.txt
- * puzzle3x3-03.txt
- * puzzle3x3-04.txt
- * puzzle3x3-05.txt
- * puzzle3x3-06.txt
- * puzzle3x3-07.txt
- * puzzle3x3-08.txt
- * puzzle3x3-09.txt
- * puzzle3x3-10.txt
- * puzzle3x3-11.txt
- * puzzle3x3-12.txt
- * puzzle3x3-13.txt
- * puzzle3x3-14.txt
- * puzzle3x3-15.txt
- * puzzle3x3-16.txt
- * puzzle3x3-17.txt
- * puzzle3x3-18.txt
- * puzzle3x3-19.txt
- * puzzle3x3-20.txt
- * puzzle3x3-21.txt
- * puzzle3x3-22.txt
- * puzzle3x3-23.txt
- * puzzle3x3-24.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 13b: Call solution() with 3-by-3 file inputs

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-02.txt
- * puzzle3x3-03.txt
- * puzzle3x3-04.txt
- * puzzle3x3-05.txt

- * puzzle3x3-06.txt
- * puzzle3x3-07.txt
- * puzzle3x3-08.txt
- * puzzle3x3-09.txt
- * puzzle3x3-10.txt
- * puzzle3x3-11.txt
- * puzzle3x3-12.txt
- * puzzle3x3-13.txt
- * puzzle3x3-14.txt
- * puzzle3x3-15.txt
- * puzzle3x3-16.txt
- * puzzle3x3-17.txt
- * puzzle3x3-18.txt
- * puzzle3x3-19.txt
- * puzzle3x3-20.txt
- * puzzle3x3-21.txt
- * puzzle3x3-22.txt
- * puzzle3x3-23.txt
- * puzzle3x3-24.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 14a: Call moves() with 4-by-4 file inputs

- * puzzle4x4-00.txt
- * puzzle4x4-01.txt
- * puzzle4x4-02.txt
- * puzzle4x4-03.txt
- * puzzle4x4-04.txt
- * puzzle4x4-05.txt
- * puzzle4x4-06.txt
- * puzzle4x4-07.txt
- * puzzle4x4-08.txt
- * puzzle4x4-09.txt
- * puzzle4x4-10.txt
- * puzzle4x4-11.txt
- * puzzle4x4-12.txt
- * puzzle4x4-13.txt
- * puzzle4x4-14.txt
- * puzzle4x4-15.txt
- * puzzle4x4-16.txt
- * puzzle4x4-17.txt
- * puzzle4x4-18.txt

- * puzzle4x4-19.txt
- * puzzle4x4-20.txt
- * puzzle4x4-21.txt
- * puzzle4x4-22.txt
- * puzzle4x4-23.txt
- * puzzle4x4-24.txt
- * puzzle4x4-25.txt
- * puzzle4x4-26.txt
- * puzzle4x4-27.txt
- * puzzle4x4-28.txt
- * puzzle4x4-29.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 14b: Call solution() with 4-by-4 file inputs

- * puzzle4x4-00.txt
- * puzzle4x4-01.txt
- * puzzle4x4-02.txt
- * puzzle4x4-03.txt
- * puzzle4x4-04.txt
- * puzzle4x4-05.txt
- * puzzle4x4-06.txt
- * puzzle4x4-07.txt
- * puzzle4x4-08.txt
- * puzzle4x4-09.txt
- * puzzle4x4-10.txt
- * puzzle4x4-11.txt
- * puzzle4x4-12.txt
- * puzzle4x4-13.txt
- * puzzle4x4-14.txt
- * puzzle4x4-15.txt
- * puzzle4x4-16.txt
- * puzzle4x4-17.txt
- * puzzle4x4-18.txt
- * puzzle4x4-19.txt
- * puzzle4x4-20.txt
- * puzzle4x4-21.txt
- * puzzle4x4-22.txt
- * puzzle4x4-23.txt
- * puzzle4x4-24.txt
- * puzzle4x4-25.txt
- * puzzle4x4-26.txt

- * puzzle4x4-27.txt
- * puzzle4x4-28.txt
- * puzzle4x4-29.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 15: Call moves() with random solvable N-by-N boards

- * 100 random 2-by-2 boards
- * 200 random 3-by-3 boards that are <= 20 moves from goal

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

- failed on trial 110 of 200

==> **FAILED**

Total: 13/20 tests passed!

=====

* memory

Computing memory of Board

*-----

Running 8 total tests.

Memory usage of an N-by-N board

	N	student (bytes)	reference (bytes)

=> passed	4	256	240
=> passed	8	576	560
=> passed	12	1024	1008
=> passed	16	1600	1584
=> passed	20	2304	2288
=> passed	36	6400	6384
=> passed	72	23104	23088


```
=> passed      120          61504          61488
==> 8/8 tests passed
```

Total: 8/8 tests passed!

```
Student   memory = 4.00 N^2 + 32.00 N + 64.00   (R^2 = 1.000)
Reference memory = 4.00 N^2 + 32.00 N + 48.00   (R^2 = 1.000)
```

=====

```
*****
*****
*   timing
*****
*****
```

Timing Solver

*-----

Running 17 total tests.

Timing tests use your implementation of Board.java and Solver.java.
Maximum time allowed per puzzle is 10 seconds.

	filename	N	seconds	insert()	delMi
n()	max PQ size				

=> FAILED	puzzle20.txt	3	0.25	26847	986
8 (3.2x)	16979	(8.0x)			
=> FAILED	puzzle21.txt	3	2.62	293152	11138
0 (8.0x)	181772	(18.7x)			
=> FAILED	puzzle22.txt	3	5.25	545525	20189
0 (25.4x)	343635	(61.6x)			
=> FAILED	puzzle23.txt	3	4.54	473790	17579
4 (8.5x)	297996	(21.0x)			
=> FAILED	puzzle24.txt	3	0.33	42295	1644
4	25851	(2.0x)			
=> FAILED	puzzle25.txt	3	8.09	832625	31150
8 (8.8x)	521117	(21.5x)			
=> FAILED	puzzle26.txt	3	1.02	117100	4479
2 (1.5x)	72308	(3.5x)			
=> FAILED	puzzle27.txt	3	2.77	287673	11218

2 (2.1x) 175491 (5.1x)
Aborting tests: puzzle28.txt took 24.893121542 seconds to complete.
==> 0/17 tests passed

Total: 0/17 tests passed!

=====

Submission

Submission time Fri-02-Oct 16:33:30

Raw Score 57.98 / 100.00

Feedback See the [Assessment Guide](#) for information on how to interpret this report.

Assessment Summary

Compilation: PASSED
Style: PASSED
Findbugs: Potential bugs found.
API: PASSED

Correctness: 31/42 tests passed
Memory: 8/8 tests passed
Timing: 0/17 tests passed

Aggregate score: 57.98% [Correctness: 65%, Memory: 10%, Timing: 25%, Style: 0%]

Assessment Details

The following files were submitted:

total 20K

-rw-r--r-- 1 4.7K Oct 2 23:34 Board.java
-rw-r--r-- 1 4.6K Oct 2 23:34 Solver.java
-rw-r--r-- 1 2.9K Oct 2 23:34 studentSubmission.zip

```
*****
*****
*   compiling
*****
*****
```

```
% javac Board.java
```

```
*-----
```

```
=====
```

```
% javac Solver.java
```

```
*-----
```

```
Note: Solver.java uses unchecked or unsafe operations.
```

```
Note: Recompile with -Xlint:unchecked for details.
```

```
=====
```

```
% checkstyle *.java
```

```
*-----
```

```
=====
```

```
% findbugs *.class
```

```
*-----
```

```
M D UC_USELESS_OBJECT UC: Useless object stored in variable var$7 o
f method new Solver(Board)  At Solver.java:[line 57]
```

```
H C EC_UNRELATED_TYPES EC: Call to Board.equals(Solver$Node) in new
Solver(Board)  At Solver.java:[line 75]
```

```
Warnings generated: 2
```

```
=====
```

```
Testing the APIs of your programs.
```

```
*-----
```

```
Board:
```

```
Solver:
```

```
=====

*****
*****
*   correctness
*****
*****
```

Testing methods in Board

*-----

Running 22 total tests.

Tests 5, 6, 13, and 14 rely upon toString() returning results in prescribed format.

Test 1a: Test hamming() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle07.txt
- * puzzle17.txt
- * puzzle27.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 1b: Test hamming() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 2a: Test manhattan() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle07.txt
- * puzzle17.txt
- * puzzle27.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 2b: Test manhattan() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 3: Test dimension() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5

==> passed

Test 4a: Test toString() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 4b: Test toString() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 5a: Test neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 5b: Test neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10
- * 127-by-127

==> passed

Test 6a: Test neighbors() of neighbors() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 6b: Test neighbors() of neighbors() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9
- * 10-by-10

==> passed

Test 7a: Test twin() with file inputs

- * puzzle04.txt
- * puzzle00.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt

==> passed

Test 7b: Test twin() with random N-by-N boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 9-by-9

- * 10-by-10

==> passed

Test 8a: Test isGoal() on file inputs

- * puzzle00.txt
- * puzzle04.txt
- * puzzle16.txt
- * puzzle06.txt
- * puzzle09.txt
- * puzzle23.txt
- * puzzle2x2-unsolvable1.txt
- * puzzle3x3-unsolvable1.txt
- * puzzle3x3-00.txt
- * puzzle4x4-00.txt

==> passed

Test 8b: Test isGoal() on N-by-N goal boards

- * 2-by-2
- * 3-by-3
- * 4-by-4
- * 5-by-5
- * 6-by-6
- * 100-by-100

==> passed

Test 9: Check whether two Board objects can be created at the same time

- * random 3-by-3 and 3-by-3 boards
- * random 4-by-4 and 4-by-4 boards
- * random 2-by-2 and 2-by-2 boards
- * random 3-by-3 and 4-by-4 boards
- * random 4-by-4 and 3-by-3 boards

==> passed

Test 10a: Check equals()

- * reflexive
- * symmetric
- * checks that individual entries of array are equal
- * argument is object of type String
- * argument is object of type Object
- * argument is null
- * argument is Board of different dimension

==> passed

Test 10b: Test equals() on M-by-M vs. N-by-N goal boards

- * M = 2, N = 2
- * M = 3, N = 3
- * M = 4, N = 4
- * M = 2, N = 5
- * M = 5, N = 2

==> passed

Test 11: Check that Board is immutable by changing argument array after

construction and making sure Board does not mutate

==> passed

Test 12: Check that Board is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle10.txt
- * puzzle20.txt
- * puzzle30.txt
- * 2-by-2
- * 3-by-3
- * 4-by-4

==> passed

Test 13: Call hamming() on a board that is kth-neighbor of a board

- * 0th neighbor of puzzle27.txt
- * 1th neighbor of puzzle27.txt
- * 2th neighbor of puzzle27.txt
- * 13th neighbor of puzzle27.txt
- * 13th neighbor of puzzle00.txt
- * 13th neighbor of puzzle2x2-unsolvable1.txt

==> passed

Test 14: Call manhattan() on a board that is a kth-neighbor of a board

- * 0th neighbor of puzzle27.txt
- * 1th neighbor of puzzle27.txt
- * 2th neighbor of puzzle27.txt
- * 13th neighbor of puzzle27.txt
- * 13th neighbor of puzzle00.txt
- * 13th neighbor of puzzle2x2-unsolvable1.txt

==> passed

Total: 22/22 tests passed!


```
=====

*****
*****
*   correctness (substituting reference Board.java)
*****
*****
```

Testing methods in Solver

*-----

Running 20 total tests.

Test 1: Call moves() with file inputs

- * puzzle00.txt
- * puzzle01.txt
- * puzzle02.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle05.txt
- * puzzle06.txt
- * puzzle07.txt
- * puzzle08.txt
- * puzzle09.txt
- * puzzle10.txt
- * puzzle11.txt
- * puzzle12.txt
- * puzzle13.txt

==> passed

Test 2: Call solution() with file inputs

- * puzzle00.txt
- * puzzle01.txt
- * puzzle02.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle05.txt
- * puzzle06.txt
- * puzzle07.txt
- * puzzle08.txt
- * puzzle10.txt
- * puzzle15.txt

==> passed

Test 3: Create two Solver objects at the same time

- * puzzle04.txt and puzzle04.txt
- * puzzle00.txt and puzzle04.txt
- * puzzle04.txt and puzzle00.txt

==> passed

Test 4a: Call isSolvable() with file inputs

- * puzzle01.txt
- * puzzle03.txt
- * puzzle04.txt
- * puzzle17.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 4b: Call isSolvable() on random N-by-N puzzles

- * 100 random 2-by-2 boards

==> passed

Test 5: Call moves() on unsolvable puzzles

- * puzzle2x2-unsolvable1.txt
- * puzzle2x2-unsolvable2.txt
- * puzzle3x3-unsolvable1.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 6: Call solution() on unsolvable puzzles

- * puzzle2x2-unsolvable1.txt
- * puzzle2x2-unsolvable2.txt
- * puzzle3x3-unsolvable1.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 7a: Check that Solver is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-05.txt
- * puzzle3x3-10.txt

- * random 2-by-2 solvable boards

==> passed

Test 7b: Check that Solver is immutable by testing whether methods return the same value, regardless of order in which called

- * puzzle3x3-unsolvable1.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 8: Call moves() with more file inputs

- * puzzle14.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 9: Check whether equals() method in Board is called with an argument of the wrong type

- * puzzle00.txt
- * puzzle05.txt
 - detected call to equals() method in Board with an argument that is not of type Board
 - likely a bug in the critical optimization
- * puzzle10.txt
 - detected call to equals() method in Board with an argument that is not of type Board
 - likely a bug in the critical optimization
- * puzzle15.txt
 - detected call to equals() method in Board with an argument that is not of type Board
 - likely a bug in the critical optimization

==> **FAILED**

Test 10: Check that constructor throws exception if board is null

==> passed

Test 11: Check for fragile dependence on toString()

- * puzzle00.txt
- * puzzle04.txt
- * puzzle08.txt
- * puzzle12.txt

==> passed

Test 12a: Call moves() with 2-by-2 file inputs

- * puzzle2x2-00.txt
- * puzzle2x2-01.txt
- * puzzle2x2-02.txt
- * puzzle2x2-03.txt
- * puzzle2x2-04.txt
- * puzzle2x2-05.txt
- * puzzle2x2-06.txt

==> passed

Test 12b: Call solution() with 2-by-2 file inputs

- * puzzle2x2-00.txt
- * puzzle2x2-01.txt
- * puzzle2x2-02.txt
- * puzzle2x2-03.txt
- * puzzle2x2-04.txt
- * puzzle2x2-05.txt
- * puzzle2x2-06.txt

==> passed

Test 13a: Call moves() with 3-by-3 file inputs

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt
- * puzzle3x3-02.txt
- * puzzle3x3-03.txt
- * puzzle3x3-04.txt
- * puzzle3x3-05.txt
- * puzzle3x3-06.txt
- * puzzle3x3-07.txt
- * puzzle3x3-08.txt
- * puzzle3x3-09.txt
- * puzzle3x3-10.txt
- * puzzle3x3-11.txt
- * puzzle3x3-12.txt
- * puzzle3x3-13.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 13b: Call solution() with 3-by-3 file inputs

- * puzzle3x3-00.txt
- * puzzle3x3-01.txt

- * puzzle3x3-02.txt
- * puzzle3x3-03.txt
- * puzzle3x3-04.txt
- * puzzle3x3-05.txt
- * puzzle3x3-06.txt
- * puzzle3x3-07.txt
- * puzzle3x3-08.txt
- * puzzle3x3-09.txt
- * puzzle3x3-10.txt
- * puzzle3x3-11.txt
- * puzzle3x3-12.txt
- * puzzle3x3-13.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 14a: Call moves() with 4-by-4 file inputs

- * puzzle4x4-00.txt
- * puzzle4x4-01.txt
- * puzzle4x4-02.txt
- * puzzle4x4-03.txt
- * puzzle4x4-04.txt
- * puzzle4x4-05.txt
- * puzzle4x4-06.txt
- * puzzle4x4-07.txt
- * puzzle4x4-08.txt
- * puzzle4x4-09.txt
- * puzzle4x4-10.txt
- * puzzle4x4-11.txt
- * puzzle4x4-12.txt
- * puzzle4x4-13.txt
- * puzzle4x4-14.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 14b: Call solution() with 4-by-4 file inputs

- * puzzle4x4-00.txt
- * puzzle4x4-01.txt
- * puzzle4x4-02.txt
- * puzzle4x4-03.txt
- * puzzle4x4-04.txt

- * puzzle4x4-05.txt
- * puzzle4x4-06.txt
- * puzzle4x4-07.txt
- * puzzle4x4-08.txt
- * puzzle4x4-09.txt
- * puzzle4x4-10.txt
- * puzzle4x4-11.txt
- * puzzle4x4-12.txt
- * puzzle4x4-13.txt
- * puzzle4x4-14.txt

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

==> **FAILED**

Test 15: Call moves() with random solvable N-by-N boards

- * 100 random 2-by-2 boards
- * 200 random 3-by-3 boards that are <= 20 moves from goal

edu.princeton.cs.algs4.OperationCountLimitExceededException: Number of calls to methods in Board exceeds limit: 100000000

- failed on trial 6 of 200

==> **FAILED**

Total: 9/20 tests passed!

=====

* memory

Computing memory of Board

*-----

Running 8 total tests.

Memory usage of an N-by-N board

N	student (bytes)	reference (bytes)
---	-----------------	-------------------

```

=> passed      4          256          240
=> passed      8          576          560
=> passed     12         1024         1008
=> passed     16         1600         1584
=> passed     20         2304         2288
=> passed     36         6400         6384
=> passed     72        23104        23088
=> passed    120       61504        61488
==> 8/8 tests passed

```

Total: 8/8 tests passed!

Student memory = 4.00 N² + 32.00 N + 64.00 (R² = 1.000)
Reference memory = 4.00 N² + 32.00 N + 48.00 (R² = 1.000)

```

=====

*****
*****
*   timing
*****
*****

```

Timing Solver

*-----

Running 17 total tests.

Timing tests use your implementation of Board.java and Solver.java.
Maximum time allowed per puzzle is 10 seconds.

	filename	N	seconds	insert()	delMi
n()	max PQ size				

Total: 0/17 tests passed: **Could not complete tests in allotted time, which results in a reported score of 0.**

```

=====

```

