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-I used java programming language (Java version 17.0.6) and Apache NetBeans IDE 17 in my project and I executed my tests in these environments.

-All tiles on the 3x3 board are created in a one-dimensional array.

-The blank space is represented by the number 0.

-I produced both a version of my project that can be run on the console and a similar version that can be used by modifying the code in the IDE to accurately measure the runtime.

First, let's execute the following search algorithms on a start state where we choose. Then we compare under the same conditions.

\* The algorithms were tested on the same computer.

\* The way they are run is the same for all algorithms.

1	2	4
3	0	5
7	6	8

**START STATE**



0	1	2
3	4	5
6	7	8

**GOAL STATE**

## Breadth-first search

```
Output - UninformedSearchforDirectWork (run) ×
run:
Goal found.
NUMBER OF NODES EXPANDED 3475
MAXIMUM SIZE OF THE FRINGE 2196
BUILD SUCCESSFUL (total time: 0 seconds)
||
```

This algorithm finds a solution if one exists. Memory usage is a bigger problem than others.

## Depth-first search

```
Output - UninformedSearchforDirectWork (run) ×
run:
Goal found.
NUMBER OF NODES EXPANDED 27637
MAXIMUM SIZE OF THE FRINGE 20262
BUILD SUCCESSFUL (total time: 1 minute 28 seconds)
```

Memory usage is less than Breadth-first search. If the left subtree is not unbounded and a solution exists, this algorithm finds a solution.

## Depth limited search

If the depth limit value is between 0 and 20 :

```
Output - UninformedSearchforDirectWork (run) ×
run:
Goal not found at this depth.You can increase the depth value.
BUILD SUCCESSFUL (total time: 0 seconds)
||
```

If depth limit value is equal 20 :

```
Output - UninformedSearchforDirectWork (run) ×
run:
Goal found.
NUMBER OF NODES EXPANDED 1414
MAXIMUM SIZE OF THE FRINGE 19
BUILD SUCCESSFUL (total time: 0 seconds)
```

If depth limit value is more than 20 :

```
Output - UninformedSearchforDirectWork (run) ×
run:
Goal found.
NUMBER OF NODES EXPANDED 35658
MAXIMUM SIZE OF THE FRINGE 28
BUILD SUCCESSFUL (total time: 42 seconds)
```

*(In this example, the depth limit 32 was tried.)*

If we choose the wrong depth, this algorithm cannot find a solution. But if we choose a good depth, we can easily find a solution.

## Iterative deepening search

```
Output - UninformedSearchforDirectWork (run) ×
run:
Goal found.
NUMBER OF NODES EXPANDED 1414
MAXIMUM SIZE OF THE FRINGE 19
BUILD SUCCESSFUL (total time: 2 seconds)
```

Iterative deepening search found the goal node by systematically trying each depth level one by one instead of we give a depth limit value in Depth Limited Search. For this reason, it gives us the same values at the 20th depth level in Depth Limited Search. However, it took more time than giving depth by manual.