Gebze Technical University
Computer Engineering

CSE 222 - 2019 Spring

HOMEWORK 3 REPORT

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1 INTRODUCTION

1.1 Problem Definition

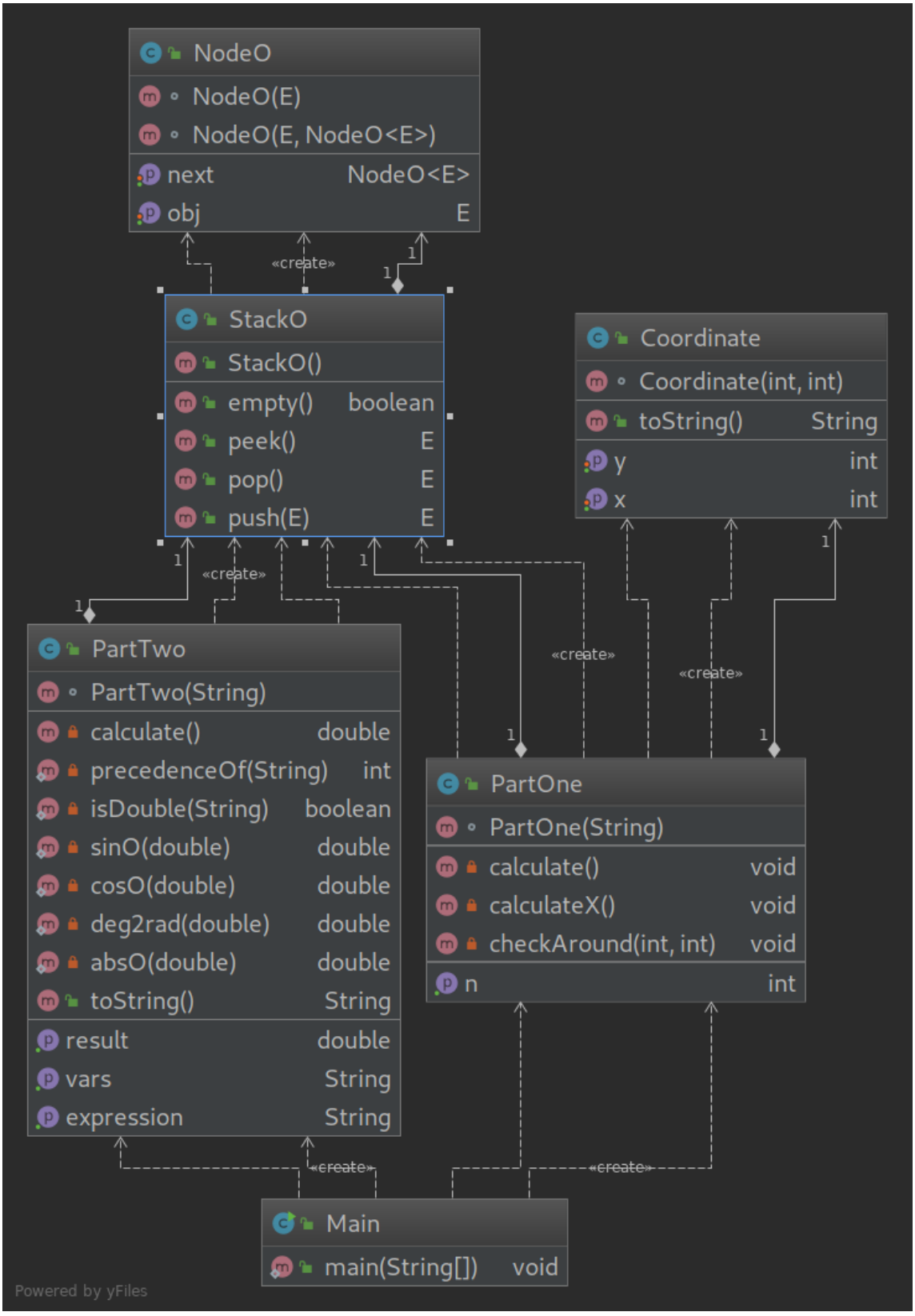
In this homework, the problem to learn the Stack data structure. This homework has two questions. One of them is to build matrix component finder and the other is to prepare an infix expression calculator. We have to write the stack structure from scratch and use it properly.

1.2 System Requirements

The first problem requires a matrix text file and the second one requires an expression file. The computer needs the Java Virtual Machine.

2 METHOD

2.1 Class Diagrams



2.2 Use Case Diagrams

Not required. All of the inputs are getting from text files.

2.3 Problem Solution Approach

For the first question, I use two different algorithms. I wrote an algorithm which does the counting while traversing in columns and rows, and at the same time pushing the obsolete components to a stack. After that, the program pops the stack and decreasing the component number for each different stack element. It has O(n) complexity.

The second algorithm is the depth-first algorithm. It has O(n) complexity too. It pushes the near white elements to the stack if the location is white and increases components counter by 1. Then, it applies the same procedure to each element of the stack but except the counter increasing.

For the second question, I have used the Shunting-Yard algorithm. It is in the book we using and I have already used this when I was at highschool. After the infix to postfix conversion, the program calculates the result recursively. Firstly, pops the last element, if it is a number returns it, if it is an operator calls the same method second times if it is sin or cos os abs it calls the same methods one time.

To placing the variables, I've used two stacks, variables into the first stack and values into the second stack. After that, all the expression elements and variables are traversing and replacing with values. It has O(n^2) complexity.

3 RESULT

3.1 Test Cases

I have used for Q1 7 and for Q2 3 test files. I tested the algorithms for every case which came to my mind.

3.2 Running Results

```
Please select the question number.
1 - Counting components
2 - A calculator
1
Please write the file path.
```

```
test_file_1.txt
0 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0
0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1
0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1
0 0 0 0 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0
0 0 0 0 0 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1
9
```

```
test_file_2.txt
1 1 0 0 1 1 0 0
1 1 1 1 1 1 0 0
1
```

```
test_file_3.txt
1 0 0 0 0 0 0 1 1 1 1 1 0
1 0 1 1 1 1 0 1 1 0 0 1 0
1 1 1 0 0 1 1 1 0 0 0 0 0
1
```

test_file_4.txt

```
1 0 0 0 1 1 1 1 0 0 0
1 0 0 0 0 0 1 0 0 0 0
1 0 0 0 1 1 1 1 0 0 0
1 1 1 0 1 0 0 0 0 0 0
0 0 1 0 1 1 1 0 1 1 1
1 0 1 0 0 0 1 0 0 1 0
1 0 1 1 0 0 1 0 0 1 0
1 1 0 1 1 1 1 0 1 1 0
0 1 0 1 1 0 0 0 1 0 1
0 1 1 0 1 1 0 0 0 1 1
4
```

test_file_5.txt

```
1 0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0 0
1 1 1 0 0 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0 0 0
1 1 1 0 0 0 0 0 0 0 0
1 0 1 1 0 0 0 0 0 0 0
1 1 0 1 0 0 0 0 0 0 0
0 1 0 1 1 0 0 0 0 0 0
0 1 1 0 1 1 0 0 0 0 0
1
```

test_file_6.txt

```
1 0 0 0 1 1 1 1 1 1 1 1 1
1 0 0 0 1 0 0 0 0 0 0 0 0
1 1 0 0 1 0 0 0 0 0 0 1 0
0 1 0 0 1 1 1 1 1 0 0 1 0
0 1 1 0 1 0 0 0 1 0 0 1 0
0 0 1 0 1 0 1 1 1 0 0 1 0
0 1 1 0 1 0 0 0 0 0 0 1 0
0 1 0 0 1 0 1 1 1 1 0 1 0
0 1 0 0 1 1 0 0 0 1 1 0 0
0 1 1 0 0 1 0 1 1 0 1 1 1
0 0 1 1 0 0 0 0 1 0 0 0 1
0 0 0 1 1 1 0 0 1 0 1 0 0
0 0 0 0 0 1 1 1 1 0 1 1 1
5
```

```
test_file_7.txt
0 0 0 0 0 0 0 1 1 1 0 0 0 1 1
0 0 0 0 1 0 0 0 1 0 0 0 0 0 1
0 0 0 0 1 1 0 0 1 1 1 0 0 1 1
0 0 1 0 0 1 1 0 0 1 1 0 0 1 0
0 0 1 1 0 1 0 1 0 0 1 0 0 1 0
0 0 1 1 1 1 0 0 0 0 1 1 1 1 0
0 0 0 0 1 1 1 1 1 1 1 0 0 0 1
3
```

```
Please select the question number.
1 - Counting components
2 - A calculator
2
```

```
infix_test_file_1.txt
w = 5   x = 6
( w + 4 ) * ( cos( x ) - 77.9 )
-692.1493029416855
```

```
infix_test_file_2.txt
y = 3   z = 16
( y + sin( y * z ) ) + ( z * abs( -10.3 ) )
168.5431448254774
```

```
infix_test_file_3.txt
a = 45  b = 90  c = 135
cos( a ) + sin( b ) - abs( c )
-133.29289321881345
```