GIT Department of Computer Engineering

CSE 222/505 - Spring 2020

Homework 4 Report

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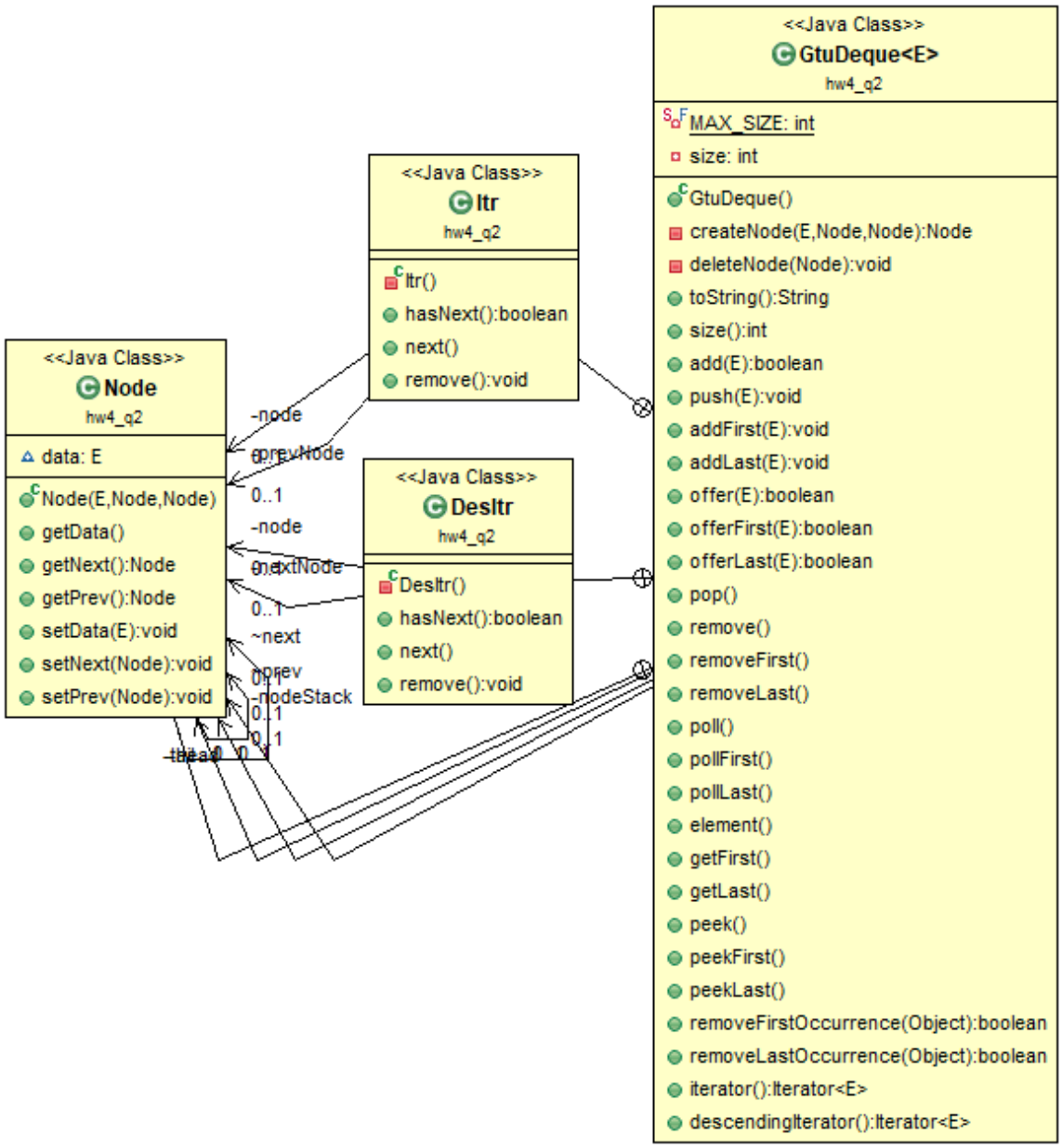
Q2:

Class Diagram:



Problem Solution Approach:

In this part we are expected to create a Deque class by implementing Deque interface. When an element is removed from the deque, instead of deleting the element with its node and leaving it to garbage collector, it should clear the element and pass the node to a stack which contains all deleted nodes. This way when there is a need for a new node this deque can use the ones moved to the stack instead of creating new one. To achieve this, I created two methods to handle node allocation operations. One is for creating nodes (or getting already removed ones) and the other is for removing them (passing them to the stack). And I used these methods all the time, whenever I need. I implemented nodes as a double linked list node, so every node point to one next and one previous node. And I implemented two iterators, one for iterating from beginning to the end and it is vice versa for the other.

Test Cases:

```
112
113             deq2.add(null);
114         }
115
```

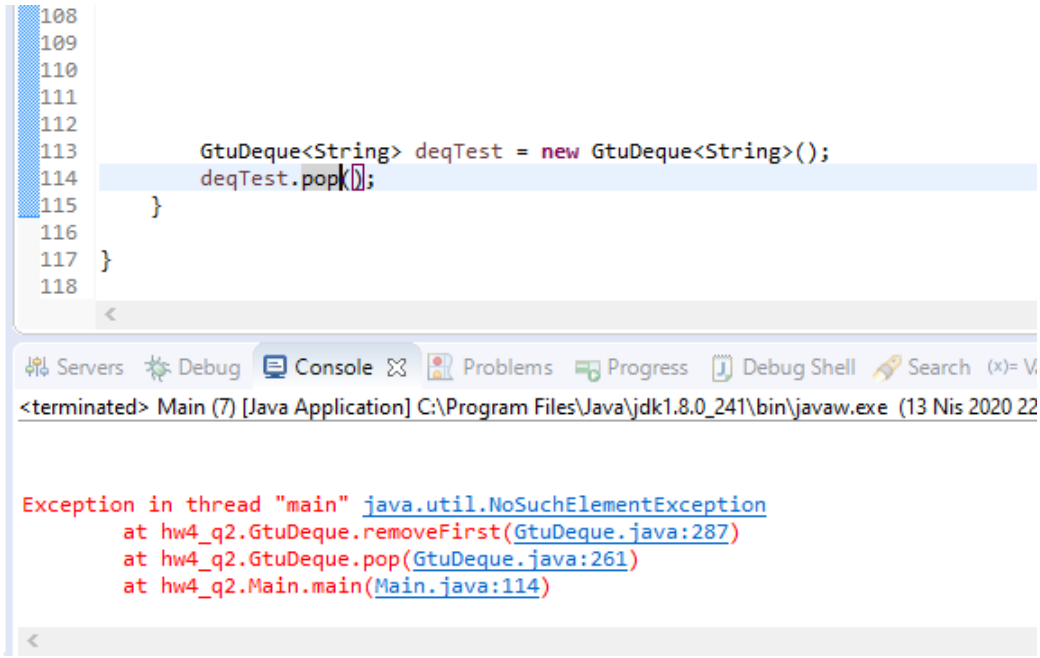
Servers Debug Console Problems Progress Debug Shell Search

```
<terminated> Main (7) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (13 Nis 20

Exception in thread "main" java.lang.IllegalArgumentException
        at hw4_q2.GtuDeque.offerLast(GtuDeque.java:229)
        at hw4_q2.GtuDeque.addLast(GtuDeque.java:162)
        at hw4_q2.GtuDeque.add(GtuDeque.java:112)
        at hw4_q2.Main.main(Main.java:113)
```

```
111
112
113             GtuDeque<String> deqTest = new GtuDeque<String>();
114             deqTest.getFirst();
115         }
116
117 }
118
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variab

```
<terminated> Main (7) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (13 Nis 2020 21:58:2

Exception in thread "main" java.util.NoSuchElementException
        at hw4_q2.GtuDeque.getFirst(GtuDeque.java:395)
        at hw4_q2.Main.main(Main.java:114)
```



```
108
109
110
111
112
113         GtuDeque<String> deqTest = new GtuDeque<String>();
114         deqTest.pop();
115     }
116
117 }
118
```

Servers | Debug | Console | Problems | Progress | Debug Shell | Search

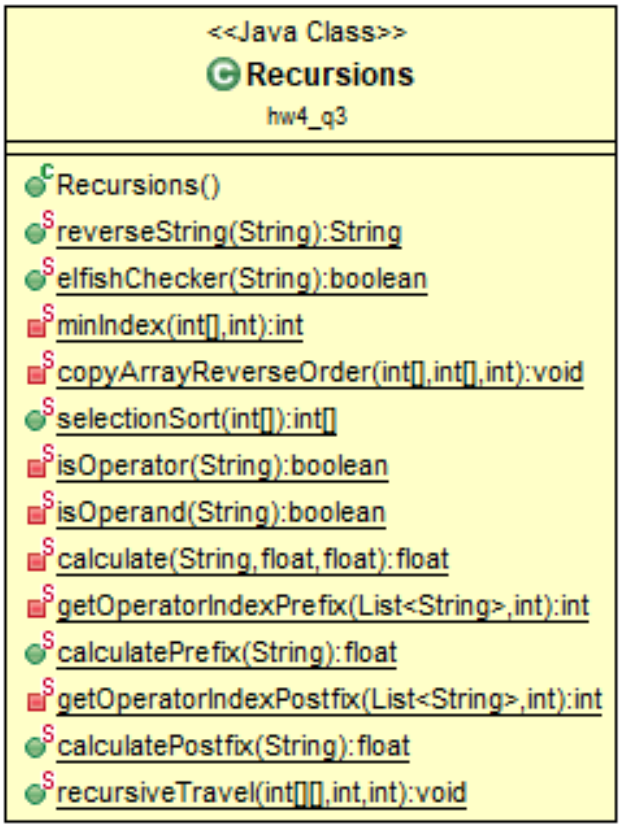
```
<terminated> Main (7) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (13 Nis 2020 22

Exception in thread "main" java.util.NoSuchElementException
        at hw4_q2.GtuDeque.removeFirst(GtuDeque.java:287)
        at hw4_q2.GtuDeque.pop(GtuDeque.java:261)
        at hw4_q2.Main.main(Main.java:114)
```

Running Command and Results:

```
Integer deque:
    add(4)                  : [4]
    add(5)                  : [4, 5]
    push(3)                 : [3, 4, 5]
    addFirst(1)             : [1, 3, 4, 5]
    addLast(8)              : [1, 3, 4, 5, 8]
    trying offer(null)      : [1, 3, 4, 5, 8] - catched!
    offerFirst(-5)          : [-5, 1, 3, 4, 5, 8]
    offerLast(11)           : [-5, 1, 3, 4, 5, 8, 11]
    pop()                   : [1, 3, 4, 5, 8, 11]
    remove()                : [3, 4, 5, 8, 11]
    removeFirst()           : [4, 5, 8, 11]
    removeLast()            : [4, 5, 8]
    poll()                  : [5, 8]
    pollFirst()             : [8]
    pollLast()              : []

String deque:
    element()                                   : Implement             : [Implement, a, Deque, class, which, implements, Deque, interface, and, can, extend, AbstractCollection]
    getFirst()                                  : Implement             : [Implement, a, Deque, class, which, implements, Deque, interface, and, can, extend, AbstractCollection]
    getLast()                                   : AbstractCollection    : [Implement, a, Deque, class, which, implements, Deque, interface, and, can, extend, AbstractCollection]
    peek()                                      : Implement             : [Implement, a, Deque, class, which, implements, Deque, interface, and, can, extend, AbstractCollection]
    peekFirst()                                 : Implement             : [Implement, a, Deque, class, which, implements, Deque, interface, and, can, extend, AbstractCollection]
    peekLast()                                  : AbstractCollection    : [Implement, a, Deque, class, which, implements, Deque, interface, and, can, extend, AbstractCollection]
    removeFirstOccurrence("can")                : true                  : [Implement, a, Deque, class, which, implements, Deque, interface, and, extend, AbstractCollection]
    removeLastOccurrence("AbstractCollection")  : true                  : [Implement, a, Deque, class, which, implements, Deque, interface, and, extend]
    print using iterator()                      :                       : [Implement, a, Deque, class, which, implements, Deque, interface, and, extend]
    print using descending iterator()           :                       : [extend, and, interface, Deque, implements, which, class, Deque, a, Implement]
```

Q3:

Class Diagram:



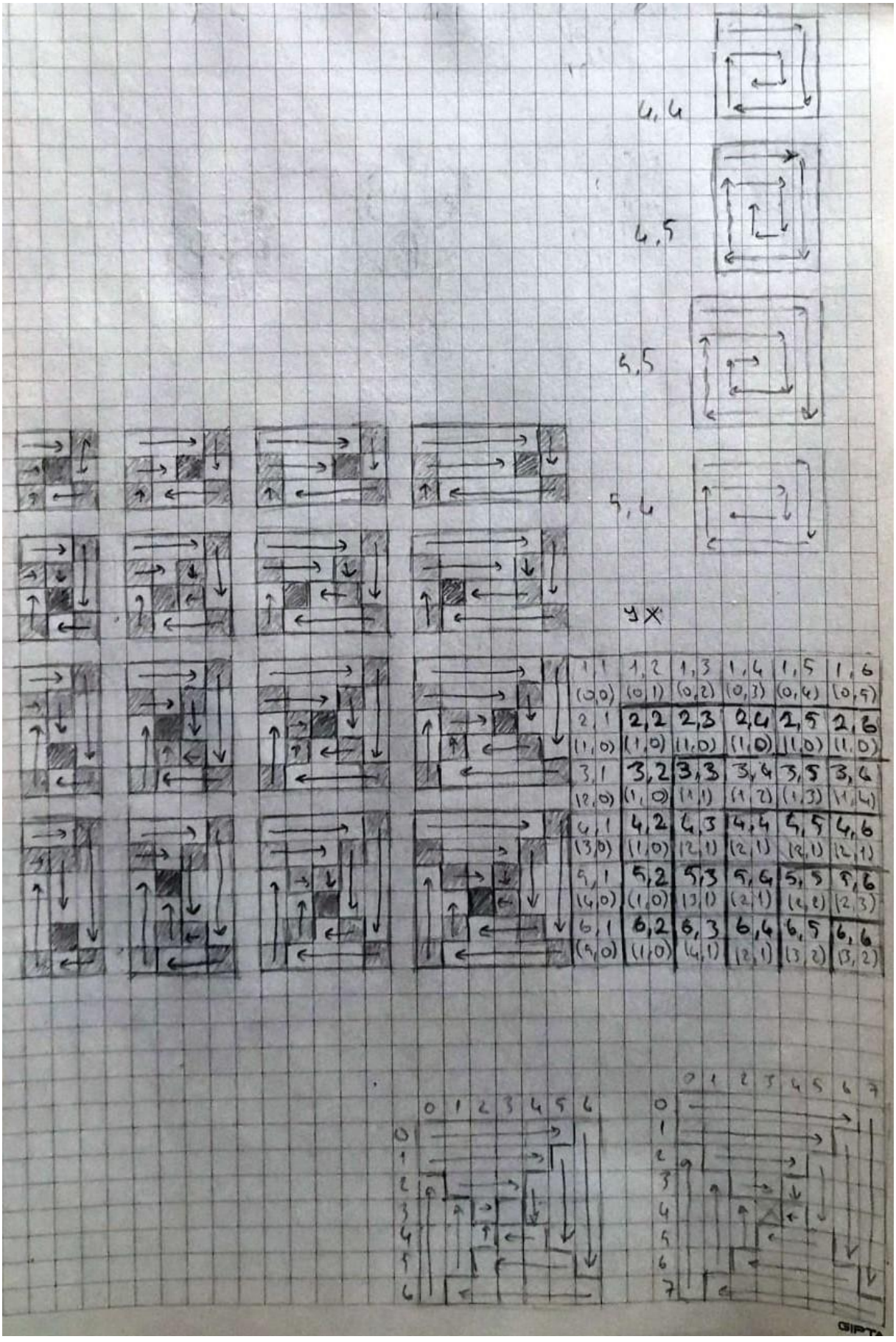
Problem Solution Approach:

1- Reverse String: First, I split the string into string list separating them with space characters. Then I returned summation of the last element of the list and same recursive method which takes the lists all elements except the last one, joined as a string by separating every element with spaces, as an argument.

2- Elfish Checker: I checked the first character of the given string if it contains any of e l or f characters and passed its substring to itself.

3- Selection Sort: Method swaps the minimum element in the array and first element of the array and calls itself by giving its sub array which contains all elements except the first one, as an argument. Then takes the called recursive methods output and insert the minimum found element on top of the array and returns.

4- Postfix Evaluation: Method takes every token one by one separated with spaces. Method expects to encounter two operands an one operator, if it encounters 3 operands, it takes first encountered operand and find its operator by iterating over string. When found, it passes all the tokens between the first encountered operand and its newly found operator as an argument to the recursive method called and take its result as the second operand. Then evaluate the notation.
5- Prefix Evaluation: Same as Postfix, iterating over string in reverse order.
6- Recursive Travel: When I wrote some possible combinations of x and y sizes of the array, there begins to appear a pattern for iterating over the 2d array as requested. Using math we can simply identify this pattern basically, if our coordinate is in y <= x + 1 and y < minimum edge length / 2 and y < x edge size iterate right as calling itself, or in x edge size – x <= y and x edge size – x < minimum edge length / 2 and x edge size – x < y edge size – y iterate down as calling itself and so on…


4,4
4,5
5,5
5,6
y x
1,1 1,2 1,3 1,4 1,5 1,6
(0,0) (0,1) (0,2) (0,3) (0,4) (0,5)
2,1 2,2 2,3 2,4 2,5 2,6
(1,0) (1,0) (1,0) (1,0) (1,0) (1,0)
3,1 3,2 3,3 3,4 3,5 3,6
(2,0) (1,0) (1,1) (1,2) (1,3) (1,4)
4,1 4,2 4,3 4,4 4,5 4,6
(3,0) (1,0) (2,1) (2,1) (2,1) (2,1)
5,1 5,2 5,3 5,4 5,5 5,6
(4,0) (1,0) (3,1) (2,1) (2,2) (2,3)
6,1 6,2 6,3 6,4 6,5 6,6
(5,0) (1,0) (4,1) (2,1) (3,2) (3,2)
0 1 2 3 4 5 6
0 1 2 3 4 5 6
0 1 2 3 4 5 6 7
0 1 2 3 4 5 6 7

Test Cases:

```
65
66
67          Recursions.reverseString(null);
68      }
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variab

```
<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (13 Nis 2020 22:10:1

Exception in thread "main" java.lang.IllegalArgumentException
        at hw4_q3.Recursions.reverseString(Recursions.java:29)
        at hw4_q3.Main.main(Main.java:67)
```

```
65
66
67          Recursions.elfishChecker(null);
68      }
69
70  }
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables Breakpoints

```
<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (13 Nis 2020 22:12:36 – 22:12:38)

Exception in thread "main" java.lang.IllegalArgumentException
        at hw4_q3.Recursions.elfishChecker(Recursions.java:44)
        at hw4_q3.Main.main(Main.java:67)
```

```
66
67          Recursions.selectionSort(null);
68      }
69
70  }
71
```

Servers Debug Console Problems Progress Debug Shell

```
<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (

Exception in thread "main" java.lang.IllegalArgumentException
        at hw4_q3.Recursions.selectionSort(Recursions.java:88)
        at hw4_q3.Main.main(Main.java:67)
```

```
66
67          Recursions.calculatePostfix(null);
68      }
69
70  }
71
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Var

<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (13 Nis 2020 22:1

```
Exception in thread "main" java.lang.NullPointerException
        at hw4_q3.Recursions.calculatePostfix(Recursions.java:192)
        at hw4_q3.Main.main(Main.java:67)
```

```
65
66
67          Recursions.calculatePrefix("? 3 2");
68      }
69
70  }
71
```

Servers Debug Console Problems Progress Debug Shell Search (x)

<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (13 Nis 2020

```
Exception in thread "main" java.lang.IllegalArgumentException
        at hw4_q3.Recursions.calculatePrefix(Recursions.java:169)
        at hw4_q3.Main.main(Main.java:67)
```

```
66
67          Recursions.calculatePostfix("? 3 2");
68      }
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables

<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (13 Nis 2020 22:15:40 – 22:

```
Exception in thread "main" java.lang.IndexOutOfBoundsException: Index: 0, Size: 0
        at java.util.ArrayList$SubList.rangeCheck(ArrayList.java:1225)
        at java.util.ArrayList$SubList.get(ArrayList.java:1042)
        at hw4_q3.Recursions.getOperatorIndexPostfix(Recursions.java:173)
        at hw4_q3.Recursions.getOperatorIndexPostfix(Recursions.java:179)
        at hw4_q3.Recursions.getOperatorIndexPostfix(Recursions.java:179)
        at hw4_q3.Recursions.calculatePostfix(Recursions.java:205)
        at hw4_q3.Main.main(Main.java:67)
```

```
64
65
66
67          Recursions.recursiveTravel(
68                  new int[][] {{1,  2,  3,  4}, {5, 6, 7, 8}, {9, 10, 11, 12}, {13, 14, 15, 16}, {17, 18, 19, 20}},
69                  -1,
70                  -1
71          );
72      }
```

Servers | Debug | Console | Problems | Progress | Debug Shell | Search | Variables | Breakpoints | Expressions

<terminated> Main (6) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (13 Nis 2020 22:19:24 – 22:19:26)

```
Exception in thread "main" java.lang.IllegalArgumentException
        at hw4_q3.Recursions.recursiveTravel(Recursions.java:236)
        at hw4_q3.Main.main(Main.java:67)
```

Running Command And Results:

```
Reverse String:
    Hello World : World Hello
    Finally finished homework! : homework! finished Finally

Elfish checker:
    Aragorn: false
    Legolas: true
    Elrond: true

Selection Sort:
    [6, 4, 1, 9, 5, 2, 3, 7, 8] : [1, 2, 3, 4, 5, 6, 7, 8, 9]
    [1, 9, 2, 8, 3, 7, 4, 6, 5] : [1, 2, 3, 4, 5, 6, 7, 8, 9]
    [4, 1, 3, 2, 4, 1, 3, 2, 0] : [0, 1, 1, 2, 2, 3, 3, 4, 4]

Calculate Postfix:
    [1 2 / 10 *]: 5.0
    [1 2 - 12 2 / * 3 *]: -18.0
    [12 8 4 / - 15 4 / 2 - *]: 17.5

Calculate Prefix:
    [* / 1 2 10]: 5.0
    [* * - 1 2 / 12 2 3]: -18.0
    [* - 12 / 8 4 - / 15 4 2]: 17.5

Travel in 2D Array:
    [1 , 2 , 3 ]
    [4 , 5 , 6 ]
    [7 , 8 , 9 ]
        [1, 2, 3, 6, 9, 8, 7, 4, 5]

    [1 , 2 , 3 , 4 , 5 ]
    [14, 15, 16, 17, 6 ]
    [13, 20, 19, 18, 7 ]
    [12, 11, 10, 9 , 8 ]
        [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20]

    [1 , 2 , 3 , 4 ]
    [5 , 6 , 7 , 8 ]
    [9 , 10, 11, 12]
    [13, 14, 15, 16]
    [17, 18, 19, 20]
        [1, 2, 3, 4, 8, 12, 16, 20, 19, 18, 17, 13, 9, 5, 6, 7, 11, 15, 14, 10]
```