

IT 314 – Software Engineering

Lab 7

Akshat Jindal | 202201299

Matrix Multiplication Code

Program Inspection

Question 1. How many errors are there in the program? Mention the errors you have identified.

The only error in the program was the incorrect calculation of the values of the final product matrix.

Question 2. Which category of program inspection would you find more effective?

For this question, the Category C of the program inspection, the Computational errors were the most effective, as the failure of the code was due to the use of wrong arithmetic logic.

Question 3. Which type of error you are not able to identified using the program inspection?

In this example, all the errors in the document were identifiable using the program inspection method.

Question 4. Is the program inspection technique is worth applicable?

Due to the small length of the code and easy to find computational errors, the program inspection technique is worth applicable here.

Code Debugging

The screenshot shows an IDE with a Java file named `MatrixMultiplication.java`. The code is as follows:

```
30 {
31     int second[][] = new int[p][q];
32     int multiply[][] = new int[m][q];
33
34     System.out.println("Enter the elements of second matrix");
35
36     for ( c = 0 ; c < p ; c++ )
37         for ( d = 0 ; d < q ; d++ )
38             second[c][d] = in.nextInt();
39
40     for ( c = 0 ; c < m ; c++ )
41     {
42         for ( d = 0 ; d < q ; d++ )
43         {
44             for ( k = 0 ; k < p ; k++ )
45             {
46                 sum = sum + first[c-1][c-k]*second[k-1][k-d];
47             }
48
49             multiply[c][d] = sum;
50             sum = 0;
51         }
52     }
53
54     System.out.println("Product of entered matrices:-");
55 }
```

The IDE also shows a console window with the following output:

```
<terminated> MatrixMultiplication [Java Application] C:\Program Files\Java\jdk-22\bin\javaw.exe (20 Oct 2024, 6:34:58 pm - 6:36:46 pm) [pid: 14152]
1 0
1 0
Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: Index -1 out of bounds for length 2
    at DebuggingCodes/DebugMatrixMultiplication.MatrixMultiplication.main(MatrixMultiplication.java:46)
```

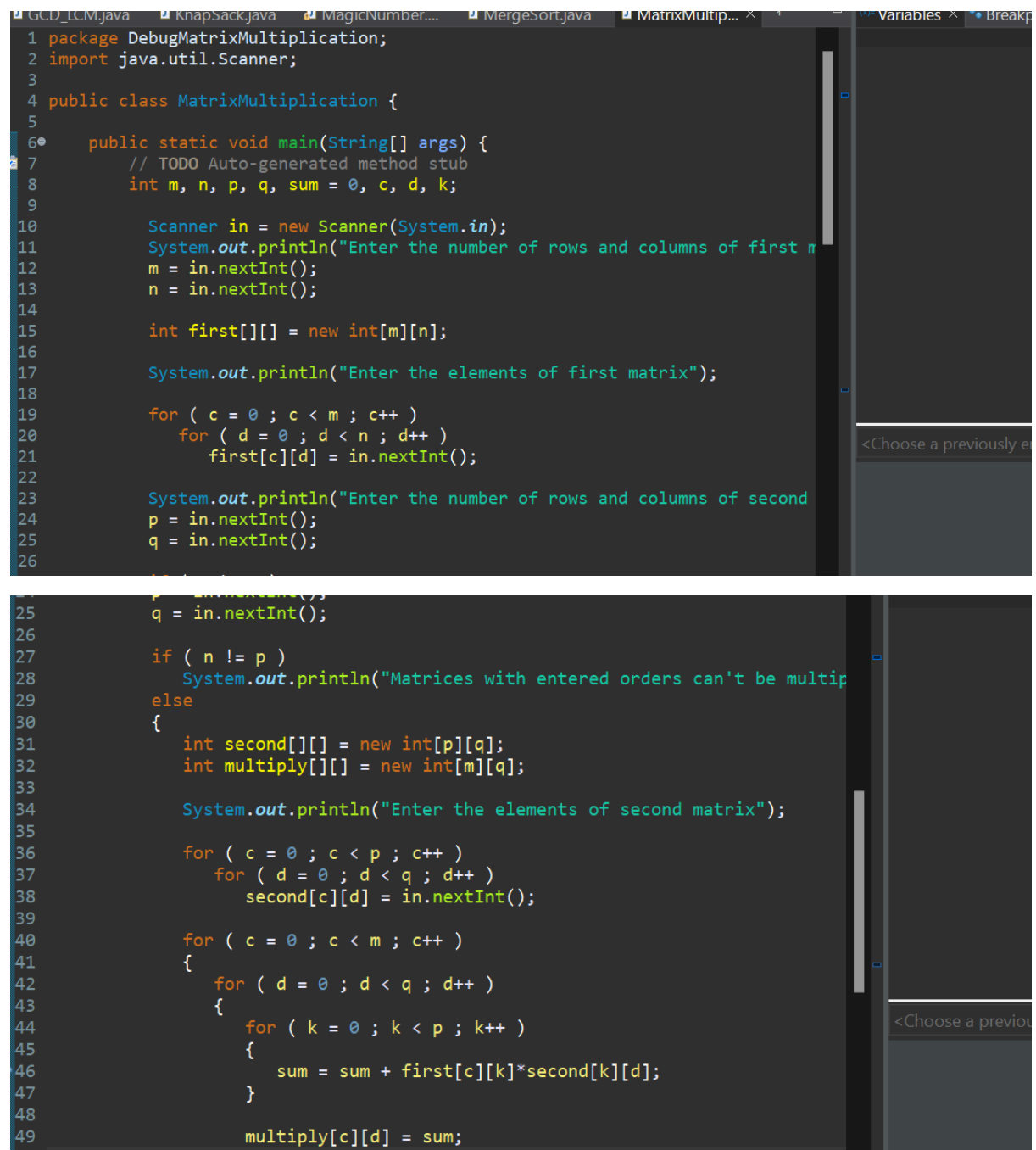
Question 1. How many errors are there in the program? Mention the errors you have identified.

There was only 1 error in the program, the calculation of the product matrix.

Question 2. How many breakpoints you need to fix those errors? What are the steps you have taken to fix the error you identified in the code fragment?

With a break point of line 46 of the code as shown, we can iterate through each loop of the code and find out the values that are being calculated. We would get an array out of bounds error, which would show us the incorrect use of the indices in calculating the sum.

Question 3. Submit your complete executable code.



The screenshot shows an IDE with a Java file named `MatrixMultiplication.java`. The code is as follows:

```
1 package DebugMatrixMultiplication;
2 import java.util.Scanner;
3
4 public class MatrixMultiplication {
5
6     public static void main(String[] args) {
7         // TODO Auto-generated method stub
8         int m, n, p, q, sum = 0, c, d, k;
9
10        Scanner in = new Scanner(System.in);
11        System.out.println("Enter the number of rows and columns of first matrix");
12        m = in.nextInt();
13        n = in.nextInt();
14
15        int first[][] = new int[m][n];
16
17        System.out.println("Enter the elements of first matrix");
18
19        for ( c = 0 ; c < m ; c++ )
20            for ( d = 0 ; d < n ; d++ )
21                first[c][d] = in.nextInt();
22
23        System.out.println("Enter the number of rows and columns of second matrix");
24        p = in.nextInt();
25        q = in.nextInt();
26
27        if ( n != p )
28            System.out.println("Matrices with entered orders can't be multiplied");
29        else
30        {
31            int second[][] = new int[p][q];
32            int multiply[][] = new int[m][q];
33
34            System.out.println("Enter the elements of second matrix");
35
36            for ( c = 0 ; c < p ; c++ )
37                for ( d = 0 ; d < q ; d++ )
38                    second[c][d] = in.nextInt();
39
40            for ( c = 0 ; c < m ; c++ )
41            {
42                for ( d = 0 ; d < q ; d++ )
43                {
44                    for ( k = 0 ; k < p ; k++ )
45                    {
46                        sum = sum + first[c][k]*second[k][d];
47                    }
48                    multiply[c][d] = sum;
49                }
50            }
51        }
52    }
53 }
```

A breakpoint is set at line 46, indicated by a blue dot in the left margin. The right sidebar shows the 'Variables' and 'Breakpoints' tabs.

```
49         multiply[c][d] = sum;
50         sum = 0;
51     }
52 }
53
54 System.out.println("Product of entered matrices:-");
55
56 for ( c = 0 ; c < m ; c++ )
57 {
58     for ( d = 0 ; d < q ; d++ )
59         System.out.print(multiply[c][d]+" ");
60
61     System.out.print("\n");
62 }
63
64 }
65
66 }
67 }
68
```

Console × Problems Debug Shell

terminated> MatrixMultiplication [Java Application] C:\Program Files\Java\jdk-22\bin\javaw.exe (20 Oct 2024, 6:40:12 pm – 6:40:26 pm) [p

1 0

1 0

Product of entered matrices:-

3 0

7 0