(DIGITAL ASSIGNMENT - 3) EXCEPTIONS AND MULTITHREADING

CSE1007(JAVA PROGRAMMING)LAB:L31-L32

MARCH 13, 2022

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ANIRUDH VADERA

(DIGITAL ASSIGNMENT - 3) EXCEPTIONS AND MULTITHREADING

EXCEPTION:

- The **Exception Handling in Java** is one of the powerful *mechanism to* handle the runtime errors so that the normal flow of the application can be maintained.
- In Java, an exception is an event that disrupts the normal flow of the program. It is an object which is thrown at runtime.
- Exception Handling is a mechanism to handle runtime errors such as ClassNotFoundException, IOException, SQLException, RemoteException, etc.

MULTITHREADING:

- **Multithreading** is a process of executing multiple threads simultaneously.
- A thread is a lightweight sub-process, the smallest unit of processing. Multiprocessing and multithreading, both are used to achieve multitasking.
- However, we use multithreading than multiprocessing because threads use a shared memory area. They don't allocate separate memory area so saves memory, and context-switching between the threads takes less time than process.
- Java Multithreading is mostly used in games, animation, etc.

ACTIVITY – 6:

QUESTION 1:

1.

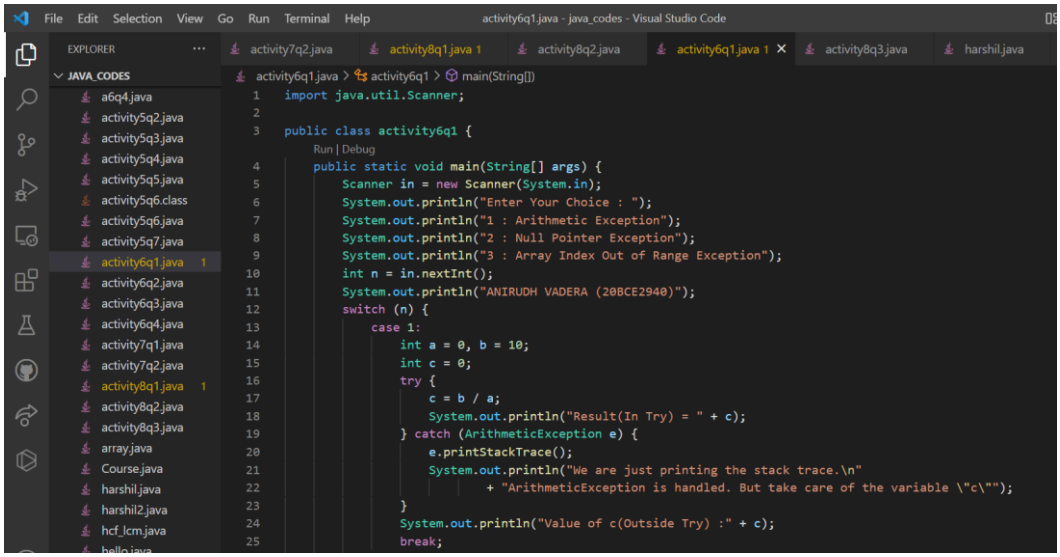
Create a program to take input from user as 1 /2 /3, if user enters 1, display info about Arithmetic Exception, 2 and 3 for Null pointer exception and Array index out of bound exception, respectively. Use, Try, Catch block for each exception individually.

CODE:

```
import java.util.Scanner;

public class activity6q1 {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.println("Enter Your Choice : ");
        System.out.println("1 : Arithmetic Exception");
        System.out.println("2 : Null Pointer Exception");
        System.out.println("3 : Array Index Out of Range Exception");
        int n = in.nextInt();
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        switch (n) {
            case 1:
                int a = 0, b = 10;
                int c = 0;
                try {
                    c = b / a;
                    System.out.println("Result(In Try) = " + c);
                } catch (ArithmeticException e) {
                    e.printStackTrace();
                    System.out.println("We are just printing the stack
trace.\n"
                            + "ArithmeticException is handled. But take care
of the variable \"c\"");
                }
                System.out.println("Value of c(Outside Try) :" + c);
                break;
            case 2:
                try {
                    String temp = null; // null value
                    System.out.println(temp.charAt(0));
                } catch (NullPointerException e) {
                    e.printStackTrace();
                    System.out.println("NullPointerException..");
                }
```

```
                break;
            case 3:
                try {
                    int[] array = { 1, 2, 3, 4, 5 }; // length is 5
                    int test = array[6]; // accessing 25th element
                    System.out.println(test);
                } catch (StringIndexOutOfBoundsException e) {
                    e.printStackTrace();
                    System.out.println("ArrayIndexOutOfBoundsException");
                }
                break;
        }
        in.close();
    }
}
```

CODE SNAPSHOT:



OUTPUT:

CASE1(ARITHMATIC EXCEPTION):

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\O
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessage
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe
Enter Your Choice :
1 : Arithmetic Exception
2 : Null Pointer Exception
3 : Array Index Out of Range Exception
1
ANIRUDH VADERA (20BCE2940)
java.lang.ArithmeticException: / by zero
        at activity6q1.main(activity6q1.java:17)
We are just printing the stack trace.
ArithmeticException is handled. But take care of the variable "c"
Value of c(Outside Try) :0
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

ANIRUDH VADERA

(DIGITAL ASSIGNMENT - 3) EXCEPTIONS AND MULTITHREADING

CASE2(NULL POINTER EXCEPTION):

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneDrive\Desktop\ja
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\Users
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin' 'activit
Enter Your Choice :
1 : Arithmetic Exception
2 : Null Pointer Exception
3 : Array Index Out of Range Exception
2
ANIRUDH VADERA (20BCE2940)
java.lang.NullPointerException: Cannot invoke "String.charAt(int)" because "temp" is null
        at activity6q1.main(activity6q1.java:29)
NullPointerException..
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

CASE3(ARRAY INDEX OUT OF RANGE EXCEPTION):

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneDrive\Desktop\java_codes'; & 'C
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\Users\Anirudh\AppData
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin' 'activity6q1'
Enter Your Choice :
1 : Arithmetic Exception
2 : Null Pointer Exception
3 : Array Index Out of Range Exception
3
ANIRUDH VADERA (20BCE2940)
Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: Index 6 out of bounds for length 5
        at activity6q1.main(activity6q1.java:38)
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

QUESTION 2:

2.
Professors are allowed to enter marks for students. Professors can enter only marks between 0 and 100 . Anything entered below 0 or above 100 is considered to be an exception.

Write a program that receives an array of marks from Professor. If the marks fail to satisfy the criteria then handle them as exceptions.

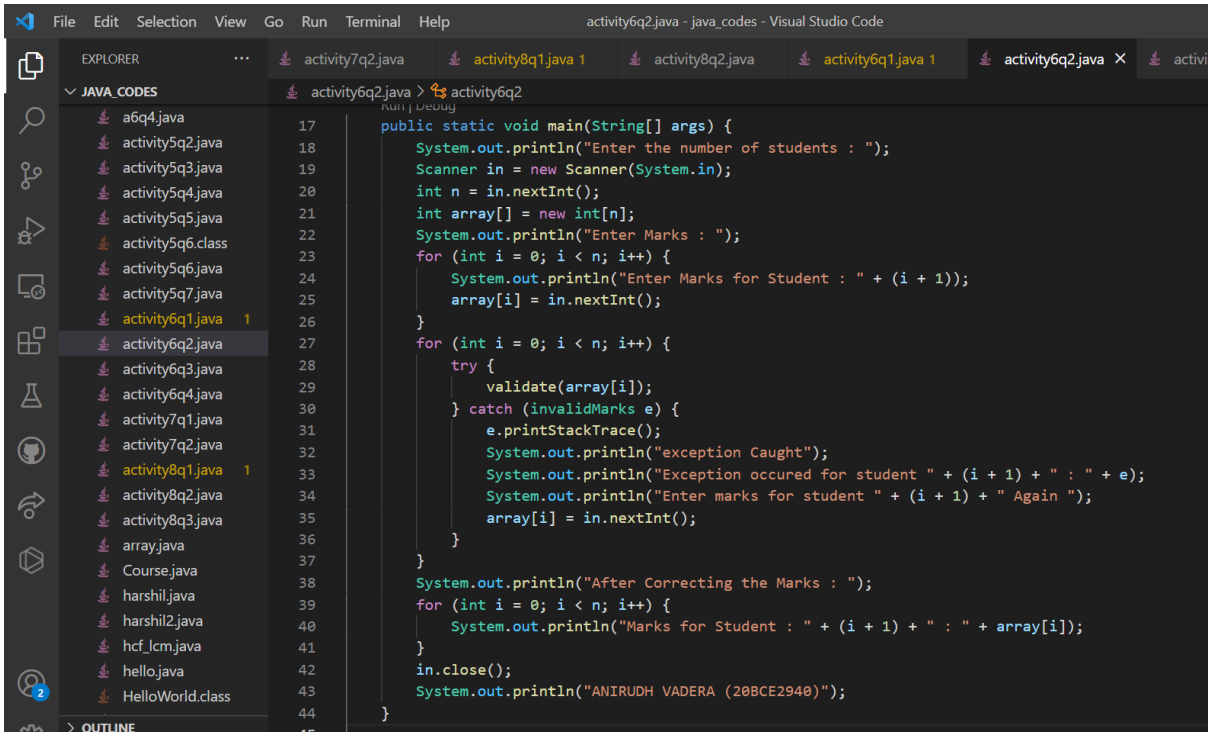
Apply Exception handling where ever necessary in this program

CODE:

```
import java.util.Scanner;

class invalidMarks extends Exception {
    public invalidMarks(String message) {
        super(message);
    }
}

public class activity6q2 {

    static void validate(int mark) throws invalidMarks {
        if (mark < 0 || mark > 100) {
            throw new invalidMarks("The Marks Should be between 0 and 100");
        }
    }

    public static void main(String[] args) {
        System.out.println("Enter the number of students : ");
        Scanner in = new Scanner(System.in);
        int n = in.nextInt();
        int array[] = new int[n];
        System.out.println("Enter Marks : ");
        for (int i = 0; i < n; i++) {
            System.out.println("Enter Marks for Student : " + (i + 1));
            array[i] = in.nextInt();
        }
        for (int i = 0; i < n; i++) {
            try {
                validate(array[i]);
            } catch (invalidMarks e) {
                e.printStackTrace();
                System.out.println("exception Caught");
                System.out.println("Exception occured for student " + (i + 1)
+ " : " + e);
```

```
                System.out.println("Enter marks for student " + (i + 1) + "
Again ");
                array[i] = in.nextInt();
            }
        }
        System.out.println("After Correcting the Marks : ");
        for (int i = 0; i < n; i++) {
            System.out.println("Marks for Student : " + (i + 1) + " : " +
array[i]);
        }
        in.close();
        System.out.println("ANIRUDH VADERA (20BCE2940)");
    }

}
```

CODE SNAPSHOT:



OUTPUT:

GIVING WRONG MARKS FOR STUDENT 4 AND 5:

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneDrive\Deskt
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin' 'a
ANIRUDH VADERA (20BCE2940)
Enter the number of students :
5
Enter Marks :
Enter Marks for Student : 1
10
Enter Marks for Student : 2
30
Enter Marks for Student : 3
90
Enter Marks for Student : 4
110
Enter Marks for Student : 5
-10
```

EXCEPTION CAUGHT FOR MARKS FOR STUDENT 4 AND 5 RE-ENTERING THEIR MARKS:

```
invalidMarks: The Marks Should be between 0 and 100
        at activity6q2.validate(activity6q2.java:13)
        at activity6q2.main(activity6q2.java:29)
exception Caught
Exception occured for student 4 : invalidMarks: The Marks Should be between 0 and 100
Enter marks for student 4 Again
80
invalidMarks: The Marks Should be between 0 and 100
        at activity6q2.validate(activity6q2.java:13)
        at activity6q2.main(activity6q2.java:29)
exception Caught
Exception occured for student 5 : invalidMarks: The Marks Should be between 0 and 100
Enter marks for student 5 Again
8
```

FINALLY DISPLAYING THE MARKS:

```
After Correcting the Marks :
Marks for Student : 1 : 10
Marks for Student : 2 : 30
Marks for Student : 3 : 90
Marks for Student : 4 : 80
Marks for Student : 5 : 8
ANIRUDH VADERA (20BCE2940)
```

QUESTION 3:

3.

Create a user defined exception class by extending exception class to handle two kind of scenario, where
(1) input cannot be zero or negative.
(2) input cannot be in the range 50 to 100
Throw object of user defined exception class and handle it by using nested try block with specific exceptions catch block. Also define finally block in the program.

CODE:

```
import java.util.Scanner;

class invalidInputLess0 extends Exception {
    public invalidInputLess0(String message) {
        super(message);
    }
}

class invalidInputNotRange extends Exception {
    public invalidInputNotRange(String message) {
        super(message);
    }
}

public class activity6q3 {

    static void validate(int input) throws invalidInputLess0,
invalidInputNotRange {
        if (input <= 0) {
            throw new invalidInputLess0("The Input is equal to 0 or
Negative");
        }
        if (input > 50 && input < 100) {
            throw new invalidInputNotRange("The Input cannot be in the range
50 to 100");
        }
    }

    public static void main(String[] args) {
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        System.out.println("Enter the Input : ");
        Scanner in = new Scanner(System.in);
        int n = in.nextInt();
        try {
            validate(n);
```

```
            try {
                validate(n);
            } catch (Exception e) {
                e.printStackTrace();
                System.out.println("Exception Caught :");
                System.out.println("Exception occured for the Input : ");
            }
        } catch (Exception e) {
            e.printStackTrace();
            System.out.println("Exception Caught :");
            System.out.println("Exception occured for the Input : ");
        } finally {
            System.out.println("Inside the finally block performing the
cleanup and closing the Scanner object :");
            in.close();
        }
    }
}
```

CODE SNAPSHOT:

INCLUDED THE NESTED TRY_CATCH BLOCK:

THE FINALLY BLOCK ALWAYS EXECUTE AND CLOSES THE SCANNER OBJECT NO MATTER WHAT:

```
Run | Debug
26      public static void main(String[] args) {
27          System.out.println("ANIRUDH VADERA (20BCE2940)");
28          System.out.println("Enter the Input : ");
29          Scanner in = new Scanner(System.in);
30          int n = in.nextInt();
31          try {
32              validate(n);
33              try {
34                  validate(n);
35              } catch (Exception e) {
36                  e.printStackTrace();
37                  System.out.println("Exception Caught :");
38                  System.out.println("Exception occured for the Input : ");
39              }
40          } catch (Exception e) {
41              e.printStackTrace();
42              System.out.println("Exception Caught :");
43              System.out.println("Exception occured for the Input : ");
44          } finally {
45              System.out.println("Inside the finally block performing the cleanup and closing the Scanner object :");
46              in.close();
47          }
48      }
49  }
50
```

OUTPUT:

CORRECT INPUT:

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  & 'C:\Program Files\Java\jdk-17.0.1\
ilsInExceptionMessages' '-cp' 'C:\Users\Anirudh\AppData\Roaming\Code\User\workspaceSto
dt_ws\java_codes_72fe121c\bin' 'activity6q3'
ANIRUDH VADERA (20BCE2940)
Enter the Input :
43
Inside the finally block performing the cleanup and closing the Scanner object :
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

WRONG INPUT (ZERO OR NEGATIVE):

```
Open folder in new window (ctrl + click)top\java_codes>  c:; cd 'c:\Users\Anirudh\OneDrive\Desktop\
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\Use
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin' 'activ
ANIRUDH VADERA (20BCE2940)
Enter the Input :
-1
invalidInputLess0: The Input is equal to 0 or Negative
        at activity6q3.validate(activity6q3.java:19)
        at activity6q3.main(activity6q3.java:32)
Exception Caught :
Exception occured for the Input :
Inside the finally block performing the cleanup and closing the Scanner object :
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneDrive\Desk
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin' 'a
ANIRUDH VADERA (20BCE2940)
Enter the Input :
0
invalidInputLess0: The Input is equal to 0 or Negative
        at activity6q3.validate(activity6q3.java:19)
        at activity6q3.main(activity6q3.java:32)
Exception Caught :
Exception occured for the Input :
Inside the finally block performing the cleanup and closing the Scanner object :
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

WRONG INPUT (IN RANGE 50 TO 100):

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneDrive\De
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp'
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin'
ANIRUDH VADERA (20BCE2940)
Enter the Input :
67
invalidInputNotRange: The Input cannot be in the range 50 to 100
        at activity6q3.validate(activity6q3.java:22)
        at activity6q3.main(activity6q3.java:32)
Exception Caught :
Exception occured for the Input :
Inside the finally block performing the cleanup and closing the Scanner object :
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

QUESTION 4:

4.

Read the following details from the user

- Username
- Password
- Confirm Password.

Write a Java Program and perform the following checks on the input data using String methods.

a) If the username or password is less than 8 characters in length then display Invalid username length or Invalid Password length to the user.

b) If the username or password contains a space then display Username or Password should not contain spaces.

c) If the password does not match confirm password then display Passwords don't match to the user.

d) If any three adjacent characters of the username in the same order is part of the password then display password cannot contain username message to the user.

CODE:

```
import java.util.Scanner;

class invalidInput extends Exception {
    public invalidInput(String message) {
        super(message);
    }
}

public class activity6q4 {

    static int check = 0;

    static void validate(String userName, String password, String
confirmPassword, int flag) throws invalidInput {

        switch (flag) {
            case 1:
                if (userName.length() < 8 || password.length() < 8) {
                    check = 0;
                    throw new invalidInput("Invalid UserName Lnegth or Invalid
Password Lnegth");
                }
                break;
            case 2:
                if (userName.contains(" ") || password.contains(" ")) {
                    check = 0;
```

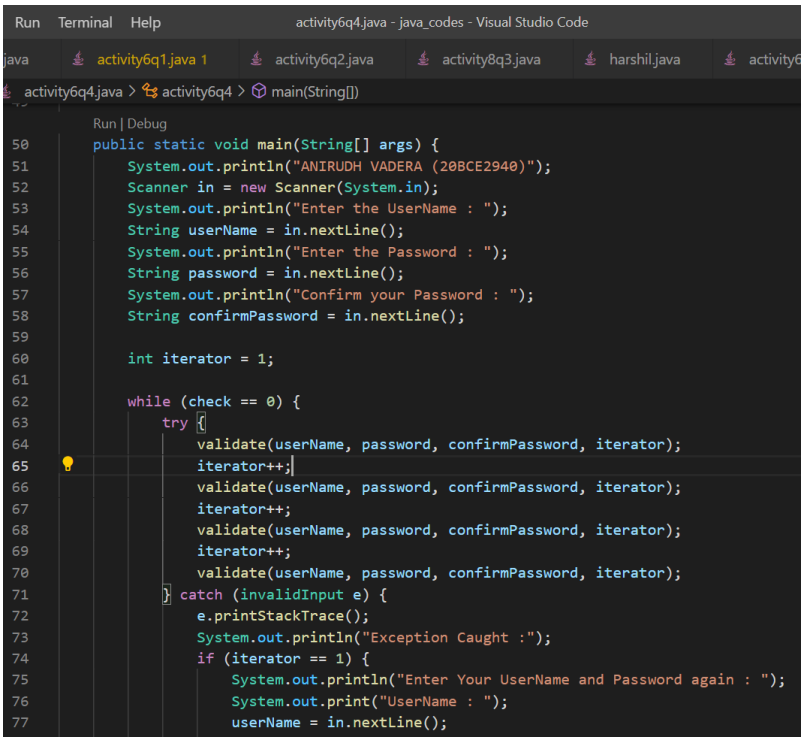
```
                    throw new invalidInput("UserName or Password should not
contain space.");
                }
                break;
            case 3:
                if (!(password.equals(confirmPassword))) {
                    check = 0;
                    throw new invalidInput("Passwords dont match : ");
                }
                break;
            case 4:
                String temp = new String();
                for (int i = 0; i < (userName.length() - 2); i++) {
                    temp = "";
                    temp = temp.concat(userName.substring(i, i + 3));
                    if (password.contains(temp)) {
                        check = 0;
                        throw new invalidInput("Passwords cannot contain
userName : ");
                    }
                }
                break;
        }
        check = 1;

    }

    public static void main(String[] args) {
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        Scanner in = new Scanner(System.in);
        System.out.println("Enter the UserName : ");
        String userName = in.nextLine();
        System.out.println("Enter the Password : ");
        String password = in.nextLine();
        System.out.println("Confirm your Password : ");
        String confirmPassword = in.nextLine();

        int iterator = 1;

        while (check == 0) {
            try {
                validate(userName, password, confirmPassword, iterator);
                iterator++;
                validate(userName, password, confirmPassword, iterator);
                iterator++;
                validate(userName, password, confirmPassword, iterator);
                iterator++;
                validate(userName, password, confirmPassword, iterator);
```

```
            } catch (invalidInput e) {
                e.printStackTrace();
                System.out.println("Exception Caught :");
                if (iterator == 1) {
                    System.out.println("Enter Your UserName and Password again
: ");
                    System.out.print("UserName : ");
                    userName = in.nextLine();
                    System.out.println();
                    System.out.print("Password : ");
                    password = in.nextLine();
                }
                if (iterator == 2) {
                    System.out.println("Enter Your UserName and Password again
: ");
                    System.out.print("UserName : ");
                    userName = in.nextLine();
                    System.out.println();
                    System.out.print("Password : ");
                    password = in.nextLine();
                }
                if (iterator == 3) {
                    System.out.println("Enter Your Passwords again : ");
                    System.out.print("Password : ");
                    password = in.nextLine();
                    System.out.println();
                    System.out.print("Confirm Password : ");
                    confirmPassword = in.nextLine();
                }
                if (iterator == 4) {
                    System.out.println("Enter Your UserName and Password again
: ");
                    System.out.print("UserName : ");
                    userName = in.nextLine();
                    System.out.println();
                    System.out.print("Password : ");
                    password = in.nextLine();
                }
            }

        }
        System.out.println("Everything is verified and correct");
        in.close();
    }
}
```

ANIRUDH VADERA

(DIGITAL ASSIGNMENT - 3) EXCEPTIONS AND MULTITHREADING

CODE SNAPSHOT:



OUTPUT:

CASE1(USERNAME OR PASSWORD LENGTH IS LESS THAN 8 RE-ENTERING THE REQUIRED):

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  & 'C:\Program Files\Ja
ilsInExceptionMessages' '-cp' 'C:\Users\Anirudh\AppData\Roaming\Code\Use
dt_ws\java_codes_72fe121c\bin' 'activity6q4'
ANIRUDH VADERA (20BCE2940)
Enter the UserName :
ANIRUDHVADERA
Enter the Password :
12345
Confirm your Password :
12345
invalidInput: Invalid UserName Lnegth or Invalid Password Lnegth
        at activity6q4.validate(activity6q4.java:19)
        at activity6q4.main(activity6q4.java:64)
Exception Caught :
Enter Your UserName and Password again :
UserName : ANIRUDHVADERA

Password : 123456789
invalidInput: Passwords dont match :
        at activity6q4.validate(activity6q4.java:31)
        at activity6q4.main(activity6q4.java:68)
Exception Caught :
Enter Your Passwords again :
Password : 123456789

Confirm Password : 123456789
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

CASE2(USERNAME OR PASSWORD CONTAINS SPACE RE-ENTERING THE REQUIRED):

```
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneD
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages'
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121
ANIRUDH VADERA (20BCE2940)
Enter the UserName :
ANIRUDH VADERA
Enter the Password :
123456789
Confirm your Password :
123456789
invalidInput: UserName or Password should not contain space.
        at activity6q4.validate(activity6q4.java:25)
        at activity6q4.main(activity6q4.java:66)
Exception Caught :
Enter Your UserName and Password again :
UserName : ANIRUDHVADERA

Password : 123456789
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

CASE3(PASSWORDS DOESN'T MATCH):

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessag
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72f
ANIRUDH VADERA (20BCE2940)
Enter the UserName :
ANIRUDHVADERA
Enter the Password :
123456789
Confirm your Password :
12345678
invalidInput: Passwords dont match :
        at activity6q4.validate(activity6q4.java:31)
        at activity6q4.main(activity6q4.java:68)
Exception Caught :
Enter Your Passwords again :
Password : 123456789

Confirm Password : 123456789
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

CASE3(3 ADJACENT CHARACTERS OF USERNAME IN ORDER IS PART OF THE PASSWORD):

IN THIS EXAMPLE FROM USERNAME(DHV) IS A PART OF PASSWORD

```
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anirudh\OneD
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMessages'
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121
ANIRUDH VADERA (20BCE2940)
Enter the UserName :
ANIRUDHVADERA
Enter the Password :
DHV123456789
Confirm your Password :
DHV123456789
invalidInput: Passwords cannot contain userName :
        at activity6q4.validate(activity6q4.java:41)
        at activity6q4.main(activity6q4.java:70)
Exception Caught :
Enter Your UserName and Password again :
UserName : ANIRUDHVADERA

Password : 123456789
Everything is verified and correct
```

IN THIS EXAMPLE FROM USERNAME(ANI) IS A PART OF PASSWORD 2 TIMES:

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\Anir
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionMe
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes
ANIRUDH VADERA (20BCE2940)
Enter the UserName :
ANIRUDHVADERA
Enter the Password :
ANI123ANI456
Confirm your Password :
ANI123ANI456
invalidInput: Passwords cannot contain userName :
        at activity6q4.validate(activity6q4.java:41)
        at activity6q4.main(activity6q4.java:70)
Exception Caught :
Enter Your UserName and Password again :
UserName : ANIRUDHVADERA

Password : 123456789
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

WHEN EVERYTHING IS ENTERED CORRECTLY:

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users\An
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExceptionM
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_code
ANIRUDH VADERA (20BCE2940)
Enter the UserName :
ANIRUDHVADERA
Enter the Password :
123456789
Confirm your Password :
123456789
Everything is verified and correct
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

ACTIVITY 7

QUESTION 1:

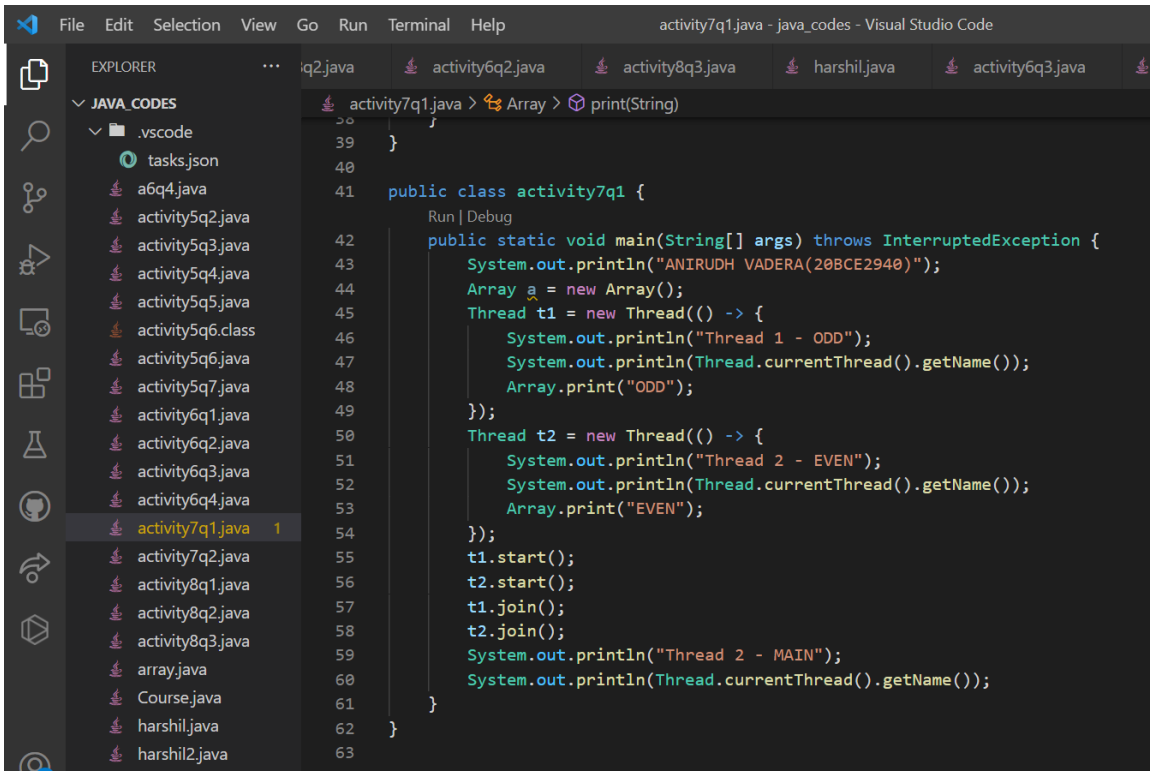
1. Demonstrate multithreading by creating two threads, one for printing the odd numbers and the other for printing even numbers with in a given range of your choice.

CODE:

```
class Array {
    static int[] a = { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 };

    public static synchronized void print(String odd_even) {
        if (odd_even.equals("ODD")) {
            System.out.println("Printing Odd Numbers");
            System.out.print("[ ");
            for (int i = 0; i < a.length; i++) {
                if (a[i] % 2 != 0) {
                    System.out.print(a[i] + " ");
                }
            }
            System.out.println("]");
        } else {
            System.out.println("Printing Even Numbers");
            System.out.print("[ ");
            for (int i = 0; i < a.length; i++) {
                if (a[i] % 2 == 0) {
                    System.out.print(a[i] + " ");
                }
            }
            System.out.println("]");
        }
    }

}

class Thread1 implements Runnable {

    public synchronized void run() {

    }
}

class Thread2 implements Runnable {
    public synchronized void run() {
```

```
    }
}

public class activity7q1 {
    public static void main(String[] args) throws InterruptedException {
        System.out.println("ANIRUDH VADERA(20BCE2940)");
        Array a = new Array();
        Thread t1 = new Thread(() -> {
            System.out.println("Thread 1 - ODD");
            System.out.println(Thread.currentThread().getName());
            Array.print("ODD");
        });
        Thread t2 = new Thread(() -> {
            System.out.println("Thread 2 - EVEN");
            System.out.println(Thread.currentThread().getName());
            Array.print("EVEN");
        });
        t1.start();
        t2.start();
        t1.join();
        t2.join();
        System.out.println("Thread 2 - MAIN");
        System.out.println(Thread.currentThread().getName());
    }
}
```

CODE SNAPSHOT:



OUTPUT:

Created an array object which has a static synchronized function to print odd and even numbers from the array as it is a static synchronized function different objects can acquire the lock and there will be no discrepancy.

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\Users
0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDetailsInExcept
eStorage\30032ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_
ANIRUDH VADERA(20BCE2940)
Thread 1 - ODD
Thread-0
Thread 2 - EVEN
Thread-1
Printing Odd Numbers
[ 1 3 5 7 9 ]
Printing Even Numbers
[ 2 4 6 8 10 ]
Thread 2 - MAIN
main
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```

QUESTION 2:

2. Write a java program to create thread that stores a set of unique numbers from 100 to 200, whose sum of digits is a factor of the same number. If the input string is not in the range, raise a user defined exception. Another thread that stores the set of unique numbers from 1 to 100 whose sum of digits is prime number. Both the threads should execute in equal intervals of 10 numbers.

CODE:

```
import java.util.Scanner;

class invalidInputNotRange1 extends Exception {
    public invalidInputNotRange1(String message) {
        super(message);
    }
}

class invalidInputNotRange2 extends Exception {
    public invalidInputNotRange2(String message) {
        super(message);
    }
}

class Thread1 implements Runnable {
    int[] number;
    int range1_low;
    int range1_high;
    int sum = 0;
    int[] array_factor = new int[100];
    int factor_elements = 0;
    int[] unique = new int[100];
    int unique_elements = 0;
    int start;
    int end;

    Thread1(int[] number, int start, int end, int range1_low, int range1_high)
{
        this.number = number;
        this.range1_high = range1_high;
        this.range1_low = range1_low;
        this.start = start;
        this.end = end;
    }

    void validate1(int input) throws invalidInputNotRange1 {
        if (input >= range1_low && input <= range1_high) {
```

```
        } else {
            throw new invalidInputNotRange1(
                    "The Input (" + input + ") is not in the Specified Range
of " + "[" +
                            range1_low + "," +
                            range1_high + "]");
        }
    }

    public void generate() {
        for (int number = range1_low; number < (range1_high + 1); number++) {
            sum = 0;
            int temp = number;
            while (temp != 0) {
                int c = temp % 10;
                sum = sum + c;
                temp = temp / 10;
            }
            if (number % sum == 0) {
                array_factor[factor_elements++] = number;
            }
        }
    }

    public void run() {
        generate();
        System.out.println("Thread 1 - Numbers whose sum of digits is a factor
ofnumber itself");
        for (int j = start; j < end; j++) {
            try {
                validate1(number[j]);
                int flag = 0;
                for (int i = 0; i < factor_elements; i++) {
                    if (number[j] == array_factor[i]) {
                        flag = 1;
                        break;
                    }
                }
                if (flag == 1) {
                    unique[unique_elements++] = number[j];
                }
            } catch (invalidInputNotRange1 e) {
                System.out.println(e);
            }
        }
        print();
    }
```

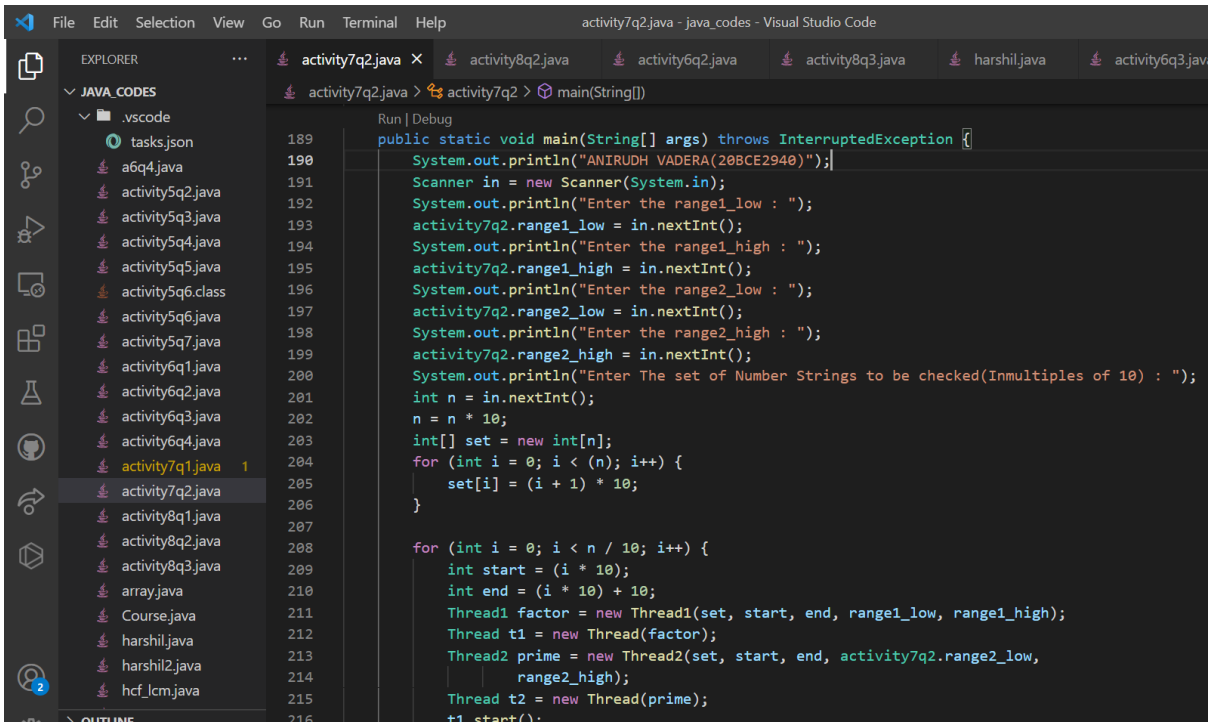
```
    public void print() {
        System.out.println("The Numbers that satisfies the conditions are :
");
        System.out.println("Printing Numbers whose sum of digits is a factor
ofnumber itself");
        System.out.print("[ ");
        for (int i = 0; i < unique_elements; i++) {
            System.out.print(unique[i] + " ");
        }
        System.out.println("]");
    }

}

class Thread2 implements Runnable {
    int[] number;
    int range2_low;
    int range2_high;
    int sum = 0;
    int[] array_factor = new int[100];
    int factor_elements = 0;
    int[] unique = new int[100];
    int unique_elements = 0;
    int start;
    int end;

    Thread2(int[] number, int start, int end, int range2_low, int range2_high)
{
        this.number = number;
        this.range2_high = range2_high;
        this.range2_low = range2_low;
        this.start = start;
        this.end = end;
    }

    void validate2(int input) throws invalidInputNotRange2 {
        if (input >= range2_low && input <= range2_high) {

        } else {
            throw new invalidInputNotRange2(
                    "The Input (" + input + ") is not in the Specified Range
of " + "[" + range2_low + "," + range2_high
                            + "]");
        }
    }

    public void generate() {
```

```
        for (int number = range2_low; number < (range2_high + 1); number++) {
            sum = 0;
            int temp = number;
            while (temp != 0) {
                int c = temp % 10;
                sum = sum + c;
                temp = temp / 10;
            }
            int flag = 0;
            for (int i = 2; i < sum; i++) {
                if (sum % i == 0) {
                    flag = 1;
                    break;
                }
            }
            if (flag == 0) {
                array_factor[factor_elements++] = number;
            }
        }
    }

    public void run() {
        generate();
        System.out.println("Thread 2 - Numbers whose sum of digits is a
PrimeNumber");
        for (int j = start; j < end; j++) {
            try {
                validate2(number[j]);
                int flag = 0;
                for (int i = 0; i < factor_elements; i++) {
                    if (number[j] == array_factor[i]) {
                        flag = 1;
                        break;
                    }
                }
                if (flag == 1) {
                    unique[unique_elements++] = number[j];
                }
            } catch (invalidInputNotRange2 e) {
                System.out.println(e);
            }
        }
        print();
    }

    public void print() {
        System.out.println("The Numbers that satisfies the conditions are :
");
```

```
        System.out.println("Printing Numbers whose sum of digits is a Prime
Number");
        System.out.print("[ ");
        for (int i = 0; i < unique_elements; i++) {
            System.out.print(unique[i] + " ");
        }
        System.out.println("]");
    }
}

public class activity7q2 {

    static int range1_low;
    static int range1_high;
    static int range2_low;
    static int range2_high;

    public static void main(String[] args) throws InterruptedException {
        Scanner in = new Scanner(System.in);
        System.out.println("Enter the range1_low : ");
        activity7q2.range1_low = in.nextInt();
        System.out.println("Enter the range1_high : ");
        activity7q2.range1_high = in.nextInt();
        System.out.println("Enter the range2_low : ");
        activity7q2.range2_low = in.nextInt();
        System.out.println("Enter the range2_high : ");
        activity7q2.range2_high = in.nextInt();
        System.out.println("Enter The set of Number Strings to be
checked(Inmultiples of 10) : ");
        int n = in.nextInt();
        n = n * 10;
        int[] set = new int[n];
        for (int i = 0; i < (n); i++) {
            set[i] = (i + 1) * 10;
        }

        for (int i = 0; i < n / 10; i++) {
            int start = (i * 10);
            int end = (i * 10) + 10;
            Thread1 factor = new Thread1(set, start, end, range1_low,
range1_high);
            Thread t1 = new Thread(factor);
            Thread2 prime = new Thread2(set, start, end,
activity7q2.range2_low,
                    range2_high);
            Thread t2 = new Thread(prime);
            t1.start();
            t1.join();
```

```
            t2.start();
            t2.join();
        }
        System.out.println("ANIRUDH VADERA(20BCE2940)");
        System.out.println("Thread 2 - MAIN");
        System.out.println(Thread.currentThread().getName());
        in.close();
    }
}
```

CODE SNAPSHOT:



OUTPUT:

Getting input:

```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  & 'C:\Program Files\Java\jdk
w' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:\Users\Anirudh\AppData\R
2ff6b908f564bf959529c93335e9\redhat.java\jdt_ws\java_codes_72fe121c\bin' 'acti
ANIRUDH VADERA(20BCE2940)
Enter the range1_low :
100
Enter the range1_high :
200
Enter the range2_low :
1
Enter the range2_high :
100
Enter The set of Number Strings to be checked(Inmultiples of 10) :
3
```

We are sending an array like [10,20,30,40……..,300]

The first 10 numbers will first go to Thread1 and then to Thread2.

➔ Sending [10,20……..,100] to Thread1 and Thread2:

```
Thread 1 - Numbers whose sum of digits is a factor ofnumber itself
invalidInputNotRange1: The Input (10) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (20) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (30) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (40) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (50) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (60) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (70) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (80) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (90) is not in the Specified Range of [100,200]
The Numbers that satisfies the conditions are :
Printing Numbers whose sum of digits is a factor ofnumber itself
[ 100 ]
Thread 2 - Numbers whose sum of digits is a PrimeNumber
The Numbers that satisfies the conditions are :
Printing Numbers whose sum of digits is a Prime Number
[ 10 20 30 50 70 100 ]
```

➔ Sending [110,120……..,200] to Thread1 and Thread2:

```
Thread 1 - Numbers whose sum of digits is a factor ofnumber itself
The Numbers that satisfies the conditions are :
Printing Numbers whose sum of digits is a factor ofnumber itself
[ 110 120 140 150 180 190 200 ]
Thread 2 - Numbers whose sum of digits is a PrimeNumber
invalidInputNotRange2: The Input (110) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (120) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (130) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (140) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (150) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (160) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (170) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (180) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (190) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (200) is not in the Specified Range of [1,100]
The Numbers that satisfies the conditions are :
Printing Numbers whose sum of digits is a Prime Number
[ ]
```

➔ Sending [210,220.....,300] to Thread1 and Thread2:

```
Thread 1 - Numbers whose sum of digits is a factor ofnumber itself
invalidInputNotRange1: The Input (210) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (220) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (230) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (240) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (250) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (260) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (270) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (280) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (290) is not in the Specified Range of [100,200]
invalidInputNotRange1: The Input (300) is not in the Specified Range of [100,200]
The Numbers that satisfies the conditions are :
Printing Numbers whose sum of digits is a factor ofnumber itself
[ ]
Thread 2 - Numbers whose sum of digits is a PrimeNumber
invalidInputNotRange2: The Input (210) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (220) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (230) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (240) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (250) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (260) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (270) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (280) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (290) is not in the Specified Range of [1,100]
invalidInputNotRange2: The Input (300) is not in the Specified Range of [1,100]
The Numbers that satisfies the conditions are :
Printing Numbers whose sum of digits is a Prime Number
[ ]
Thread 2 - MAIN
main
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```