DISCRETE(LAB 3)

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Part(1) : Prime Number Checker

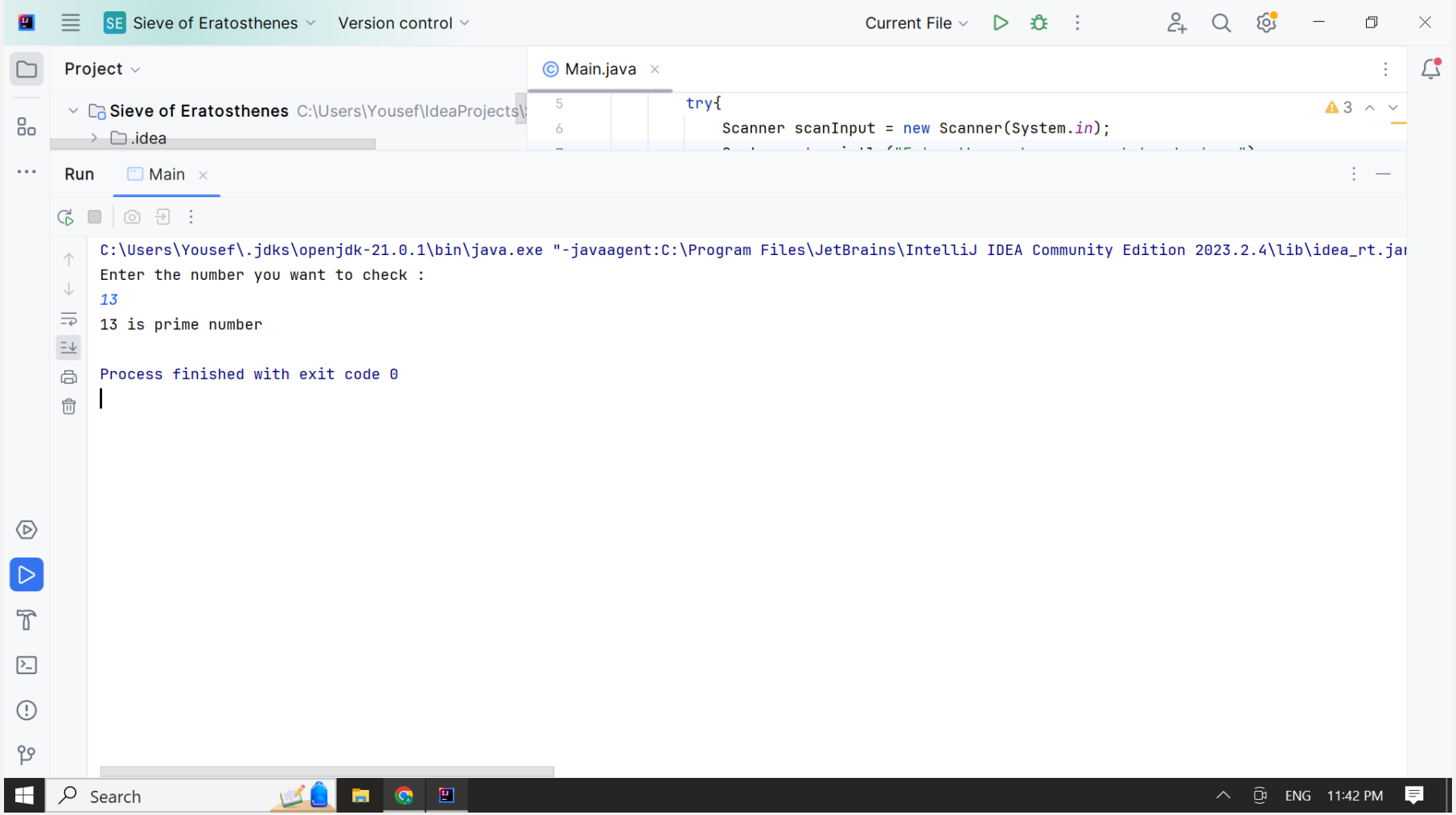
Problem statement

- Implement a function that determines whether a given positive integer is a prime number or not using Sieve of Eratosthenes

Used data structures.(no used data structures)

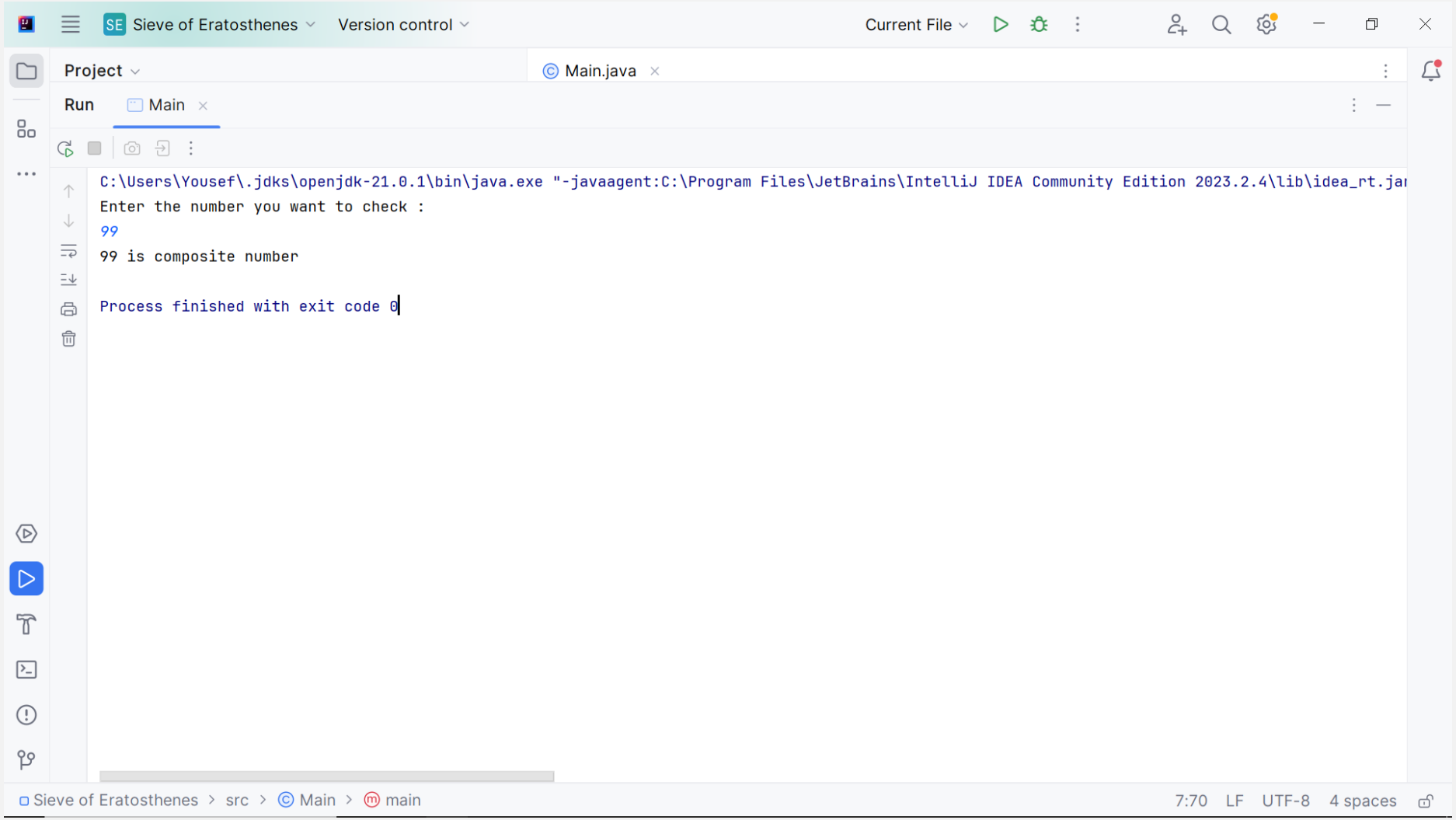
Part(1) : Prime Number Checker

Sample runs and test cases



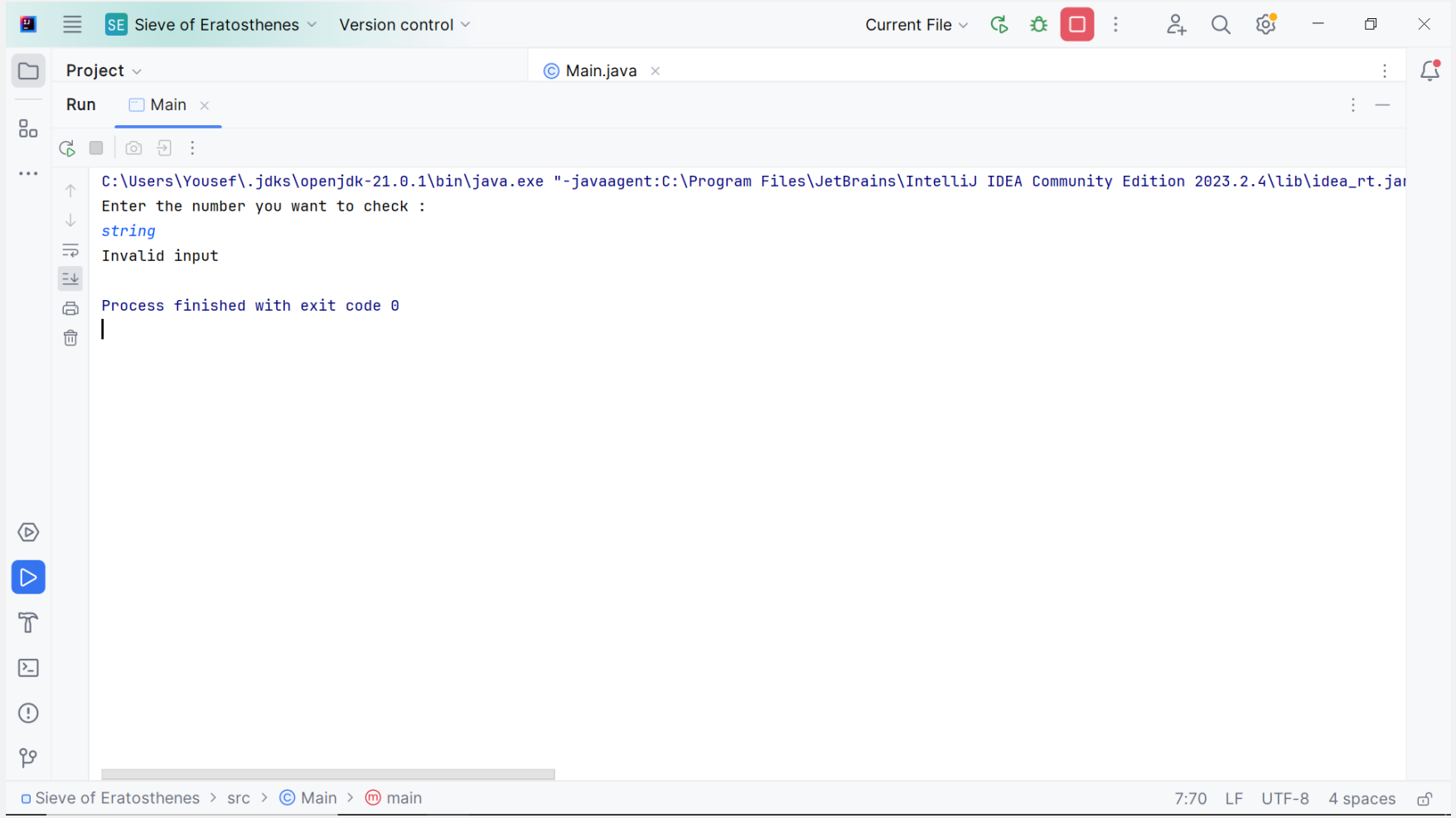
Part(1) : Prime Number Checker

Sample runs and test cases



Part(1) : Prime Number Checker

Sample runs and test cases



Part(1) : Prime Number Checker

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter the number you want to check :
-12
you entered negative number

Process finished with exit code 0
```

Part(1) : Prime Number checker

Assumption

- ❑The user input number in range of int
- ❑If the number is composite the program would say it

Part(2) : Prime Factorization

Problem statement

- ❑Create a function that computes the prime factors of a given integer.

Used data structures (Array list<Integer>)

Part(2) : Prime Factorization

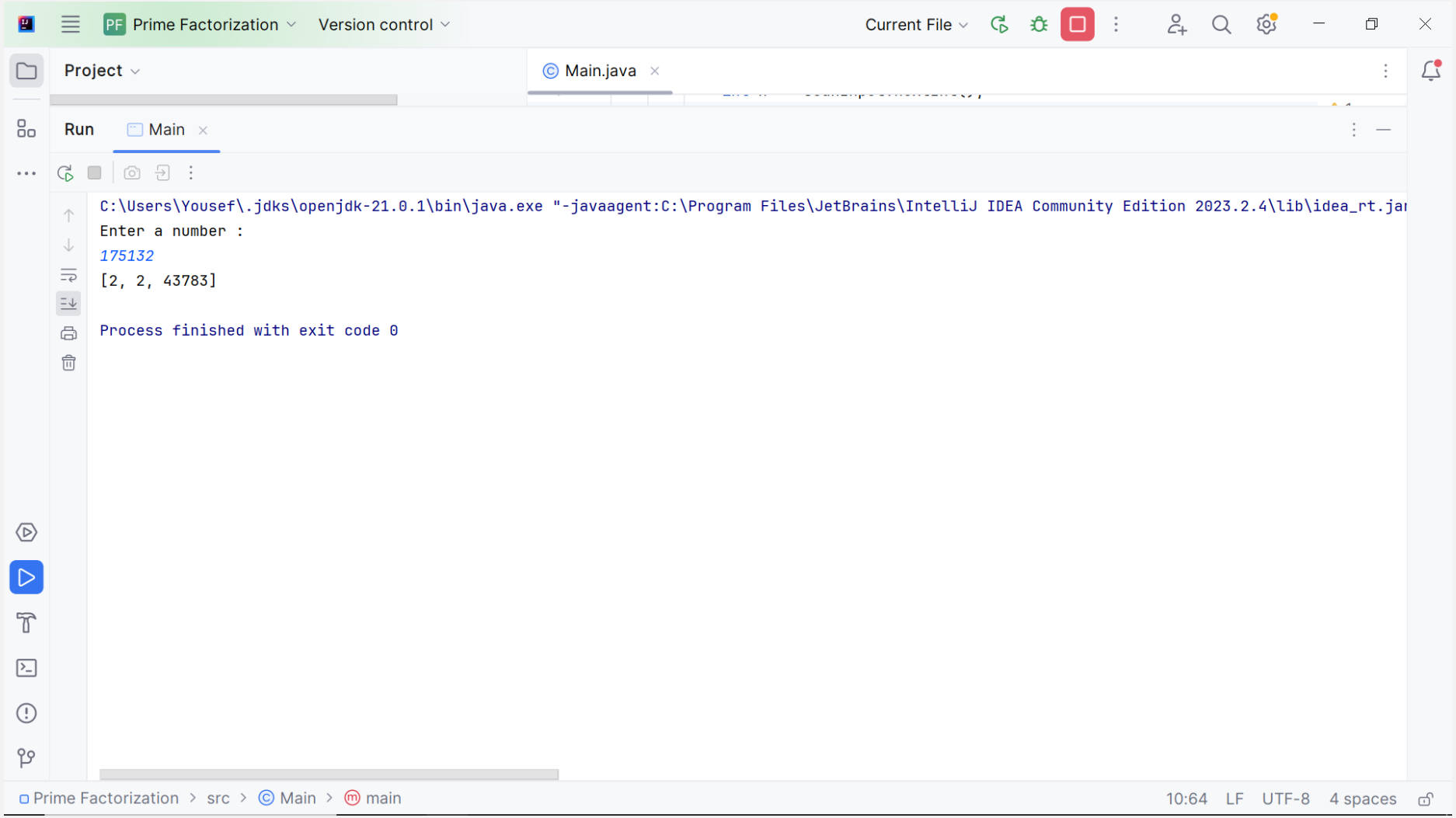
Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter a number :
88
[2, 2, 2, 11]

Process finished with exit code 0
```

Part(2) : Prime Factorization

Sample runs and test cases



Part(2) : Prime Factorization

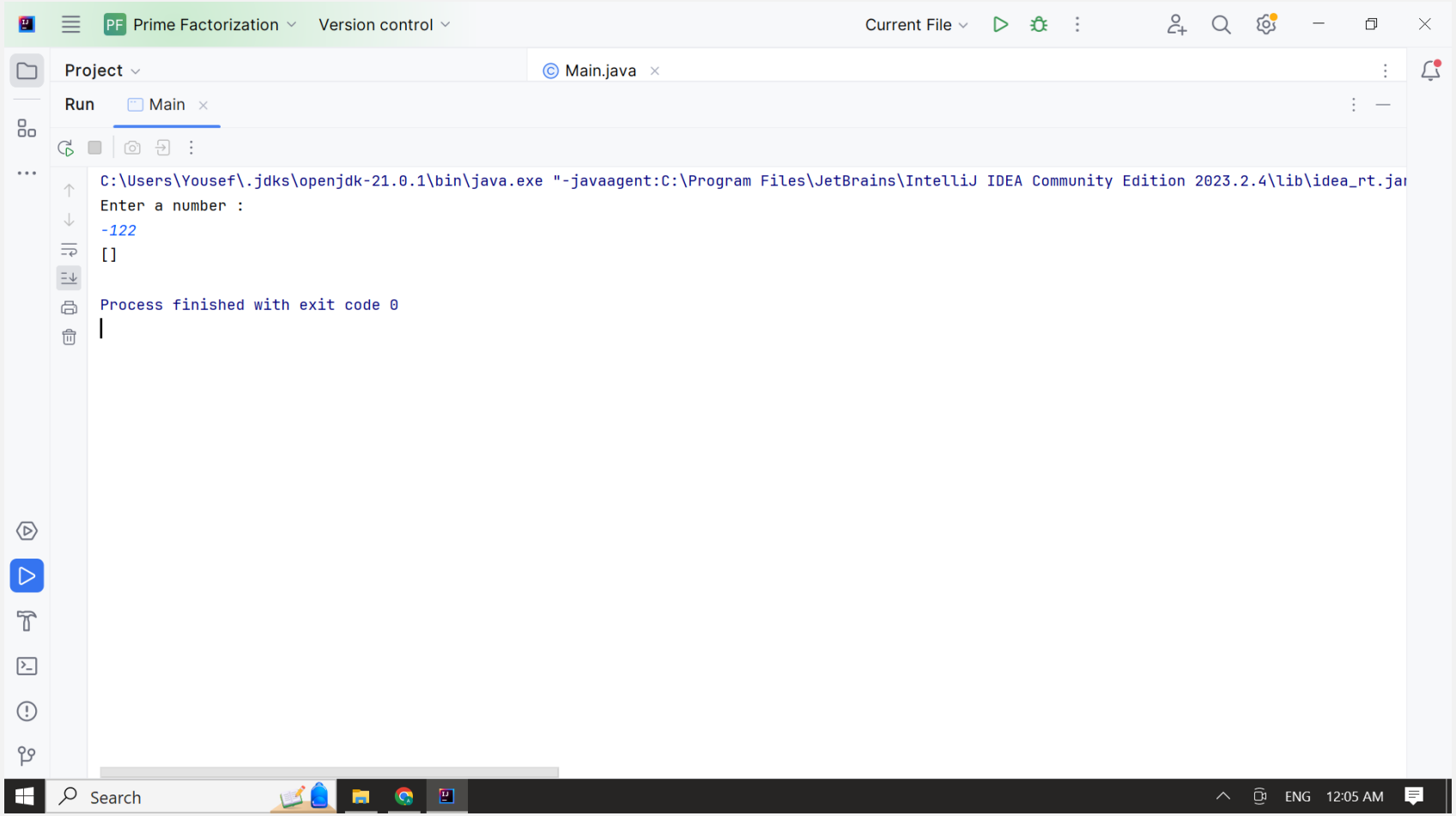
Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter a number :
2
[2]

Process finished with exit code 0
```

Part(2) : Prime Factorization

Sample runs and test cases



Part(2) : Prime Factorization

Assumption

- I assume the the user input integer values that are in the range of int data type.

- When the number is smaller than 2 , I display [] as these numbers are not in range of prime numbers.

Part(3) : GCD and LCM Computation

Problem statement

Implement functions to calculate the GCD and LCM of two positive integers.

a) Using the Euclidean algorithm for GCD computation and the relationship between GCD and LCM to find the LCM.

b) Using prime factorization.

Used data structures.(Array list<Integer>)

Part(3) : GCD and LCM Computation

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter first number :
85
Enter second number :
17
choose an option
1.solve using prime factorization
2.solve using euclid algorithm
1
GCD of 85, 17 is 17
LCM of 85, 17 is 85

Process finished with exit code 0
```

Part(3) : GCD and LCM Computation

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter first number :
85
Enter second number :
17
choose an option
1.solve using prime factorization
2.solve using euclid algorithm
2
GCD of 85, 17 is 17
LCM of 85, 17 is 85

Process finished with exit code 0
```

Part(3) : GCD and LCM Computation

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter first number :
15323
Enter second number :
21442
choose an option
1.solve using prime factorization
2.solve using euclid algorithm
1
GCD of 15323, 21442 is 1
LCM of 15323, 21442 is 328555766

Process finished with exit code 0
```

Part(3) :GCD and LCM Computation

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter first number :
15323
Enter second number :
21442
choose an option
1.solve using prime factorization
2.solve using euclid algorithm
2
GCD of 15323, 21442 is 1
LCM of 15323, 21442 is 328555766

Process finished with exit code 0
```

Part(3) : GCD and LCM Computation

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter first number :
string
invalid input

Process finished with exit code 0
```

Part(3) : GCD and LCM Computation

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter first number :
-12
Enter second number :
5
cannot calculate neither gcd nor lcm

Process finished with exit code 0
```

Part(3) : GCD and LCM Computation

Assumption

- I assume the the user input integer values that are in the range of int data type.

Part(4) : Chinese Remainder Theorem

Problem statement

- Implement Chinese remainder theorem that takes as input m1, m2, m3, ..., mn that are pairwise relatively prime and (a1, a2, ..., an) and calculates x such that x = a1 (mod m1) , x = a2 (mod m2), …, x = an (mod mn)

Used data structures.(Arrays)

Part(4) : Chinese Remainder Theorem

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter the number of Equations:
2
Enter a0:
10
Enter m0:
997
Enter a1:
15
Enter m1:
997
Cannot solve by the Chinese Remainder Theorem

Process finished with exit code 0
```

Part(2) : Prime Factorization

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter the number of Equations:
2
Enter a0:
2
Enter m0:
3
Enter a1:
3
Enter m1:
5
X = 8

Process finished with exit code 0
```

Part(4) : Chinese Remainder Theorem

Sample runs and test cases

Chinese Remainder Theorem Version control Current File

Project

Chinese Remainder Theorem C:\User
- .idea
- out
- src
  - Main

Main.java

```
int noOfEquations = scanInput.nextInt();
if(noOfEquations <= 0){
    System.out.println("no of equations is not bigger than 0");
    return ;
}
```

Run Main

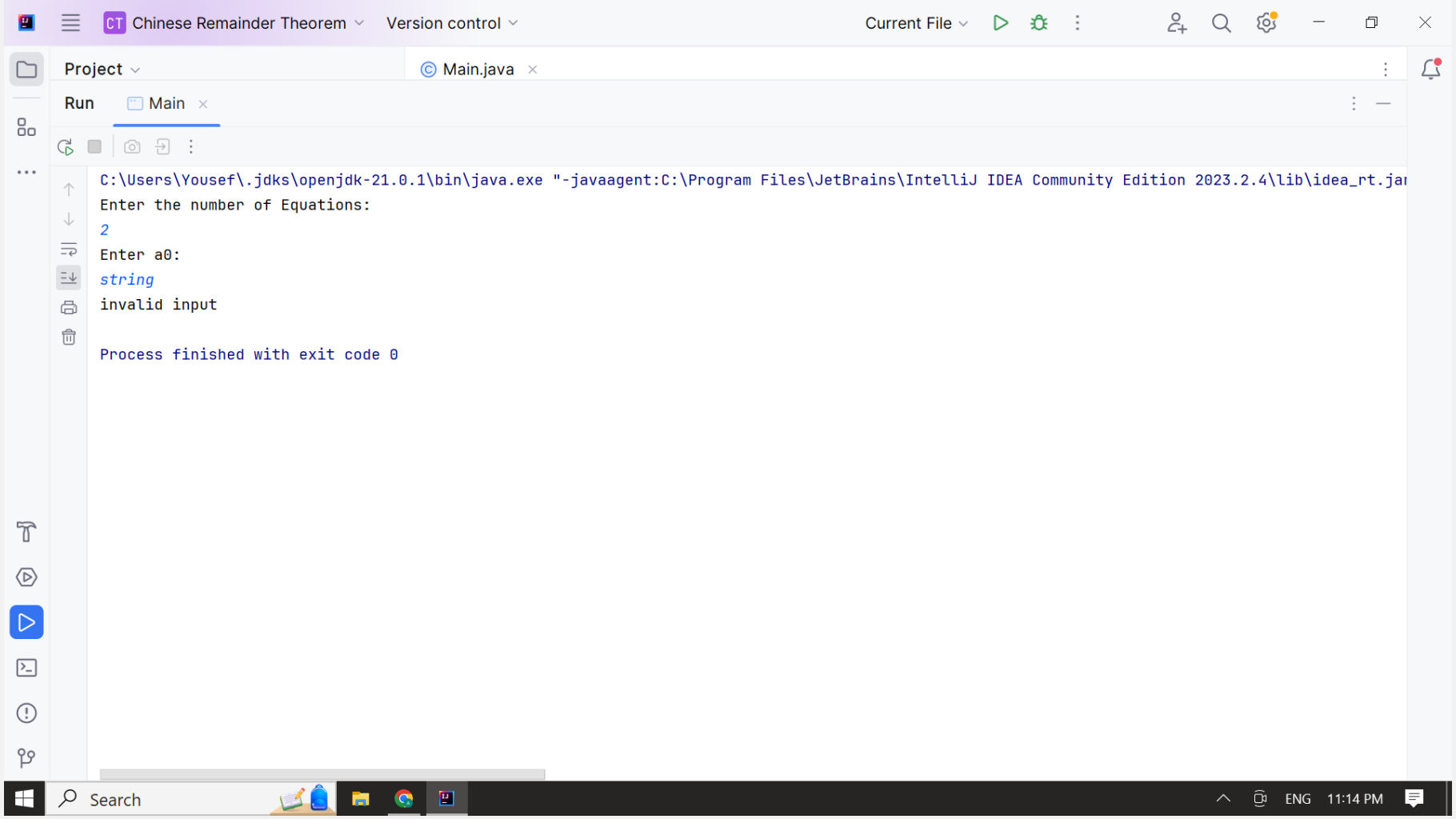
```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter the number of Equations:
-111
no of equations is not bigger than 0

Process finished with exit code 0
```

Chinese Remainder Theorem > src > Main > main 11:25 LF UTF-8 4 spaces

Part(4) : Chinese Remainder Theorem

Sample runs and test cases



Part(4) : Chinese Remainder Theorem

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter the number of Equations:
1
Enter a0:
5
Enter m0:
7
X = 5

Process finished with exit code 0
```

Part(4) : Chinese Remainder Theorem

Sample runs and test cases

```
C:\Users\Yousef\.jdks\openjdk-21.0.1\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.2.4\lib\idea_rt.jar
Enter the number of Equations:
3
Enter a0:
2
Enter m0:
3
Enter a1:
-2
Enter m1:
7
Enter a2:
3
Enter m2:
5
X = 68

Process finished with exit code 0
```

Part(4) : Chinese Remainder Theorem

Assumption

- I assume the the user input integer values that are in the range of int data type.

- The program handles the following Exceptions NumberFormatException , ArithematicException (in case some value has no modular inverse), InputMismatchException

THANKYOU

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