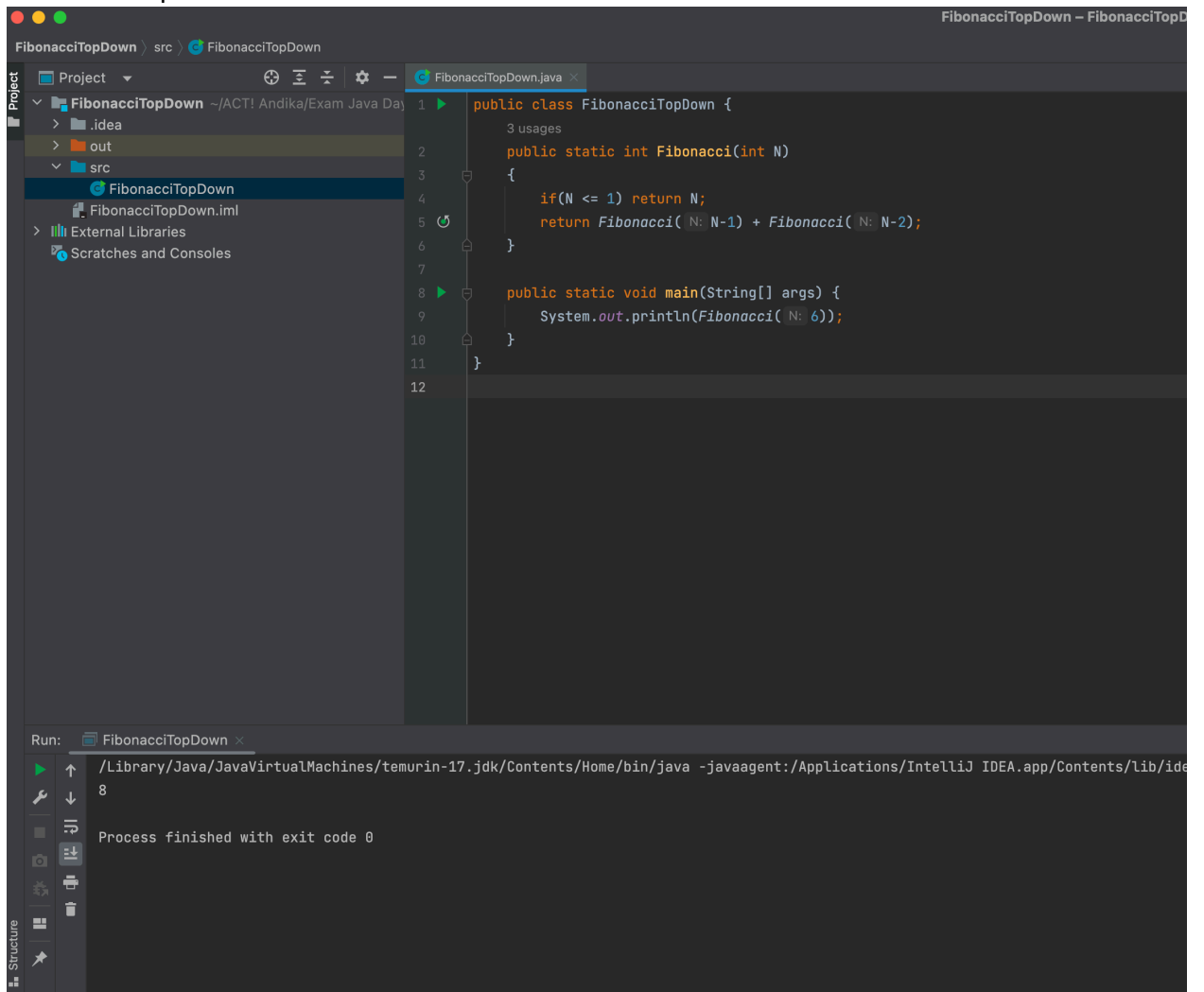


Dynamic Programming

1. Fibonacci Top-Down

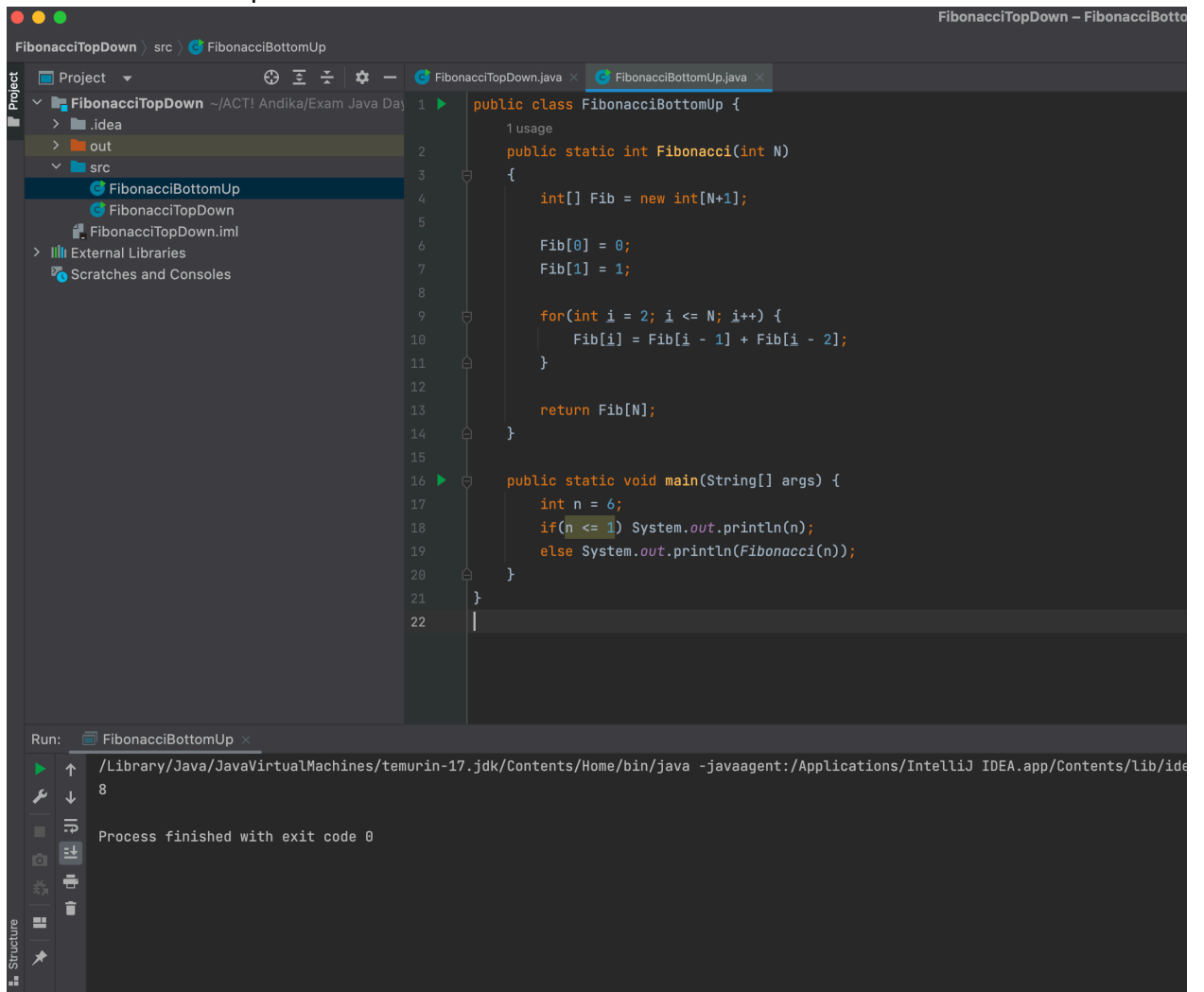


The screenshot shows an IDE window titled "FibonacciTopDown - FibonacciTopD". The left sidebar displays the project structure for "FibonacciTopDown", including folders ".idea", "out", and "src", and files "FibonacciTopDown.iml" and "Scratches and Consoles". The main editor area shows the code for "FibonacciTopDown.java":

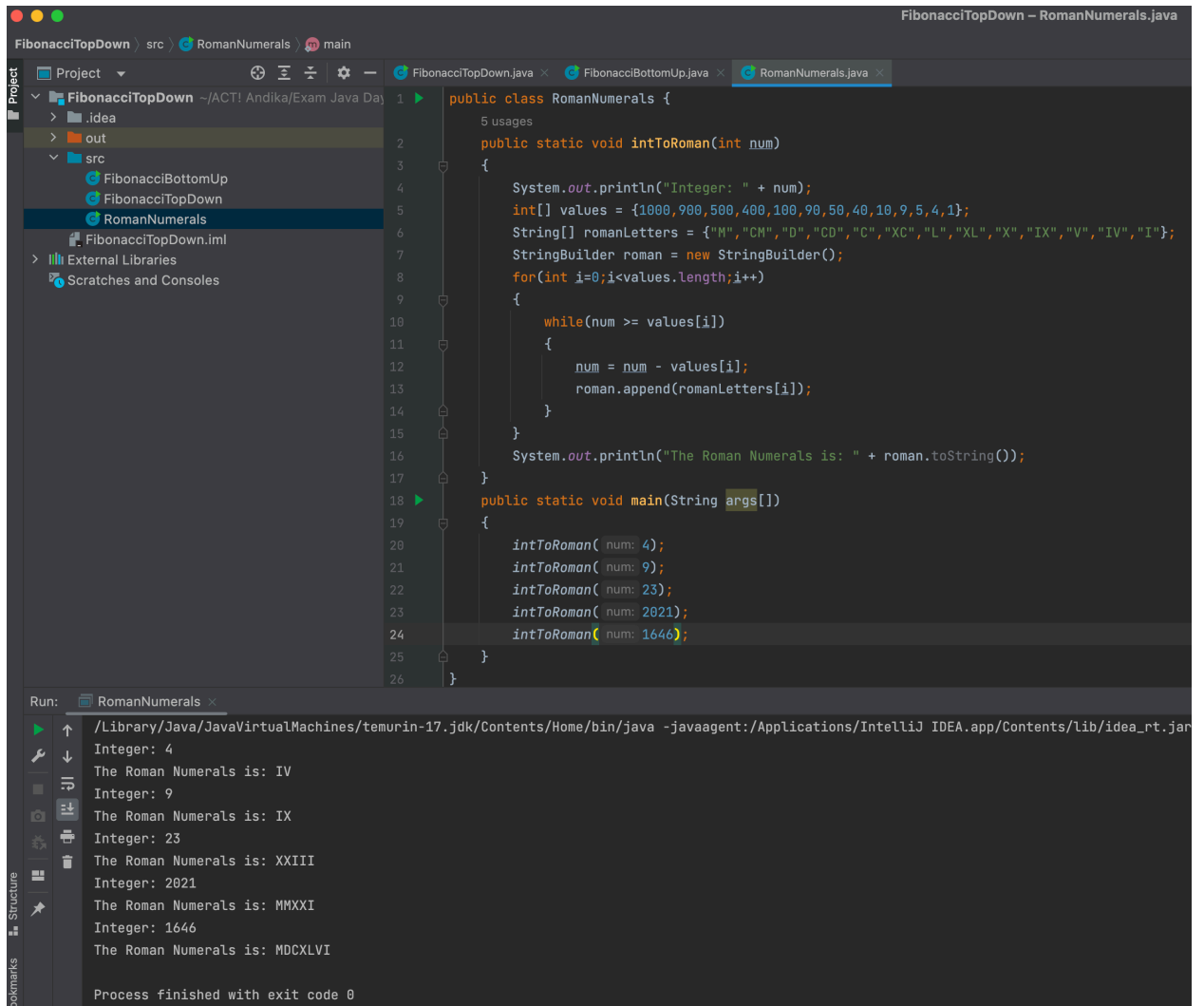
```
1 public class FibonacciTopDown {
2     3 usages
3     public static int Fibonacci(int N)
4     {
5         if(N <= 1) return N;
6         return Fibonacci( N: N-1) + Fibonacci( N: N-2);
7     }
8     public static void main(String[] args) {
9         System.out.println(Fibonacci( N: 6));
10    }
11 }
12
```

Below the code editor, the "Run" tab is active, showing the command executed: `/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/ide`. The output is `8`, and the status is "Process finished with exit code 0".

2. Fibonacci Bottom-Up



3. Frog
4. Roman Numerals



The screenshot displays the IntelliJ IDEA IDE with the `RomanNumerals.java` file open. The project structure on the left shows a package named `FibonacciTopDown` containing `FibonacciBottomUp`, `FibonacciTopDown`, and `RomanNumerals`. The `RomanNumerals.java` file contains the following code:

```
1 public class RomanNumerals {
2     5 usages
3     public static void intToRoman(int num)
4     {
5         System.out.println("Integer: " + num);
6         int[] values = {1000, 900, 500, 400, 100, 90, 50, 40, 10, 9, 5, 4, 1};
7         String[] romanLetters = {"M", "CM", "D", "CD", "C", "XC", "L", "XL", "X", "IX", "V", "IV", "I"};
8         StringBuilder roman = new StringBuilder();
9         for(int i=0; i<values.length; i++)
10        {
11            while(num >= values[i])
12            {
13                num = num - values[i];
14                roman.append(romanLetters[i]);
15            }
16        }
17        System.out.println("The Roman Numerals is: " + roman.toString());
18    }
19    public static void main(String args[])
20    {
21        intToRoman( num: 4);
22        intToRoman( num: 9);
23        intToRoman( num: 23);
24        intToRoman( num: 2021);
25        intToRoman( num: 1646);
26    }
27 }
```

The Run window at the bottom shows the execution output for the `RomanNumerals` class:

```
Run: RomanNumerals x
/Library/Java/JavaVirtualMachines/temurin-17-jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.jar
Integer: 4
The Roman Numerals is: IV
Integer: 9
The Roman Numerals is: IX
Integer: 23
The Roman Numerals is: XXIII
Integer: 2021
The Roman Numerals is: MMXXI
Integer: 1646
The Roman Numerals is: MDCXLVI
Process finished with exit code 0
```