

# Laboratory 06

COMSC-044

Fall 2020

# Laboratory 6

- A prime number is a number that is only evenly divisible by itself and 1. For example:
  - The number 5 is prime because it can only be evenly divided by 1 and 5. The number 6, however, is not prime because it can be divided by 1, 2, 3 and 6.
- Write a function called `isPrime`, which takes an integer as an argument and returns `true` if the argument is a prime number, or `false` otherwise.
- Tips:
  - Program6-15 shows you how you can use the Boolean function, `isEven(val)`, where the test is to see if the number, `val`, is odd or even. Your job is to alter the function, `isEven(val)`, in that program to see if the number is Prime or not. Call your new function, `isPrime(val)`
  - Recall that the `%` operator divides one number by another, and returns the remainder of the division. In an expression such as `num1 % num2`, the `%` operator will return 0 if `num1` is evenly divisible by `num2`.
  - What you will do is to test the number, `val`, to see if it is divisible by 2, 3, ..., `val-1`. If it is not, it is prime. If it is divisible by 2 or 3 or ... `val-1`, then it is not Prime.

# Laboratory 6A

- Call your program, *YourName*-Lab6A.cpp .
- When you have gotten your program working:
  - If you are doing the Lab synchronously, call over the instructor so that your program can be tested for accuracy.
  - If you are doing the Lab asynchronously, submit the Lab to Canvas for Assessment.

# Laboratory 6B

- Use your new function, `isPrime()`, in a program that will display all the Prime numbers which are less than 200. You can call this program: *YourName-Lab6B.cpp* .
- When you have gotten your program for part B working:
  - If you are doing the Lab synchronously, call over the instructor so that your program can be tested for accuracy.
  - If you are doing the Lab asynchronously, submit the Lab to Canvas for Assessment.

# Laboratory 6C

- Use your new function, `isPrime()`, in a program that will count all the prime numbers less than or equal to the number that you type in. You can call this program: *YourName-Lab6C.cpp* .
- Record the number of Prime Numbers per power of  $10 \leq N$ , where N is:
  - 10 – Record the number of prime numbers less than 10.
  - 100 – Record the number of prime numbers less than 100 but more than 10.
  - 1,000 – Record the number of prime numbers less than 1,000 but more than 100.
  - 10,000 – Record the number of prime numbers less than 10,000 but more than 1,000.
  - 100,000 – Record the number of prime numbers less than 100,000 but more than 10,000.
- Graph the percentage of prime numbers for each of these values of N
  - What you are graphing is: # Prime Numbers(per power of 10)/N as a function of N.
  - Call your graph: *YourName-Lab6C.jpg*

#1-digit primes/9

#2-digit/90

#3digit/900

#4dgt/9000

#5dgt/90,000

%

90

80

70

60

50

40

30

20

10

1

2

3

4

10

20

100

1000

10000

100000

N



# Laboratory 6C

- If you have a Windows based computer, then you can use Microsoft Paint.exe to draw your graph.
- If you have a Macintosh, you can use Paintbrush, which is similar to Paint.
- When you have completed your graph:
  - If you are doing the Lab synchronously, call over the instructor so that your graph can be assessed for accuracy.
  - If you are doing the Lab asynchronously, submit the graph for part 3 to Canvas for Assessment.
- Do you think the number of prime numbers (per power of 10) ever goes to zero as  $N$  goes to infinity?

## Program 6-15

```
1  // This program uses a function that returns true or false.
2  #include <iostream>
3  using namespace std;
4
5  // Function prototype
6  bool isEven(int);
7
8  int main()
9  {
10     int val;
11
12     // Get a number from the user.
13     cout << "Enter an integer and I will tell you ";
14     cout << "if it is even or odd: ";
15     cin >> val;
16
17     // Indicate whether it is even or odd.
18     if (isEven(val))
19         cout << val << " is even.\n";
20     else
21         cout << val << " is odd.\n";
22     return 0;
23 }
24
```

Returning a  
Boolean Value in  
Program 6-15

*(Program Continues)*



# Returning a Boolean Value in Program 6-15

```
25  //*****
26  // Definition of function isEven. This function accepts an      *
27  // integer argument and tests it to be even or odd. The function *
28  // returns true if the argument is even or false if the argument *
29  // is odd. The return value is a bool.                            *
30  //*****
31
32  bool isEven(int number)
33  {
34      bool status = true;
35
36      if (number % 2 != 0)
37          status = false; // The number is even if there is no remainder.
38      return status;
39  }
```

## Program Output with Example Input Shown in Bold

Enter an integer and I will tell you if it is even or odd: **5 [Enter]**  
5 is odd.