

# AMS 595 - Assignment 7

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## 1. Work Done

Github Link for the Project: <https://github.com/amol1202/AMS595-Assignment7>

This project involved implementing various programming tasks in C++ based on the given requirements. The main tasks included:

1. Translating MATLAB conditional statements to C++.
  2. Implementing a function to print vectors.
  3. Generating Fibonacci numbers using a `while` loop.
  4. Writing functions for:
    - Checking if a number is prime.
    - Finding the factors of a number.
    - Prime factorization of a number.
  5. Printing the first  $n$  rows of Pascal's Triangle using recursion or iteration.
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## 2. Implementation

Each task was implemented in C++ with proper comments and structured code.

### Task 1: Conditional Statements

The MATLAB conditional statement was translated into a C++ `switch` statement. This allows efficient handling of discrete cases.

### Task 2: Printing a Vector

A custom function `print_vector` was created to iterate over and print all elements of a vector.

### Task 3: Fibonacci Sequence

Using a `while` loop, the Fibonacci sequence was generated for terms not exceeding 4,000,000.

## Task 4: Prime, Factorization, and Prime Factorization

Functions for determining primality, finding factors, and performing prime factorization were implemented using loops and conditionals. Test cases validated correctness.

## Task 5: Pascal's Triangle

Pascal's Triangle was generated row by row, with calculations based on the binomial coefficient formula.

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## 3. Results

The following outputs were obtained for the respective tasks:

### Task 1: Conditional Statements

Input: -1

Output: negative one

### Task 2: Printing a Vector

Input: {1, 2, 3, 4}

Output: 1 2 3 4

### Task 3: Fibonacci Sequence

Output: Fibonacci numbers up to 4,000,000:

1 2 3 5 8 13 21 34 55 ...

### Task 4: Prime and Factorization

Test Cases for Prime Check:

is\_prime(2) = true, is\_prime(10) = false, is\_prime(17) = true

Test Cases for Factorization:

Factors of 72: 1 2 3 4 6 8 9 12 18 24 36 72

Test Cases for Prime Factorization:

Prime factors of 72: 2 2 2 3 3

### Task 5: Pascal's Triangle

Output for 5 rows:

```
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
```

My results after compiling and running the code in command prompt →

```
C:\Users\amoarora\OneDrive - Stony Brook University\Desktop\AMS 595 - Assignment7>g++ -o Code_File Code_File.cpp
C:\Users\amoarora\OneDrive - Stony Brook University\Desktop\AMS 595 - Assignment7>Code_File.exe

--- Conditional Statements ---
Enter a number: -1
negative one

--- Fibonacci Sequence ---
1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 2584 4181 6765 10946 17711 28657 46368 75025 121393 196418 317811 514229 832040 1346269
2178309 3524578

--- Testing Prime Function ---
is_prime(2) = 1
is_prime(10) = 0
is_prime(17) = 1

--- Testing Factorize Function ---
1 2
1 2 3 4 6 8 9 12 18 24 36 72
1 2 4 7 14 28 49 98 196

--- Testing Prime Factorize Function ---
2
2 2 2 3 3
2 2 7 7

--- Pascal's Triangle ---
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
```

Figure 1: Results in command prompt

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## 4. How to Run the Code

1. Ensure a C++ compiler (e.g., g++) is installed on your system.
2. Save the provided source code as `project.cpp`.
3. Compile the code using the command:  
`g++ -o project project.cpp`
4. Run the executable using the command:  
`./project`

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## 5. Conclusion

This project provided hands-on experience with fundamental C++ concepts, including conditional statements, loops, functions, and recursion. The implementation was verified against test cases to ensure correctness.

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