AMS 595 - Assignment 7

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1. Work Done

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
```

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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.
