

## Lab 6

### Recursive Math Functions

#### Objective

To use recursion to write math functions.

#### Assignment

Write the following three math-related recursive functions to complete the program shell below. (DO NOT MODIFY THE FUNCTION PROTOTYPES.)

- 1) **Factorials.** Every positive integer has a factorial, defined like so:  $n! = n(n-1)(n-2)(\cdots)(1)$ . Write a function that returns  $n!$ . ( $0! = 1$ )
- 2) **Fibonacci Numbers.** The Fibonacci sequence, named after the medieval Italian mathematician Leonardo Pisano Fibonacci, consists of the numbers 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89.... Each number is the sum of the previous two, with the exception of the first two, which are 1 by definition. Write a function to return the  $n$ th Fibonacci number.
- 3) **Triangular Numbers.** These are integers that can be represented as a triangular array of dots:

1	2	3	4	5
.	.	.	.	.
	..	..	..	..
		...	...	...
			....	....
				.....

The first five triangular numbers are 1, 3, 6, 10, and 15. Write a function to return the  $n$ th triangular number.

Use the following shell for your program:

```
#include <iostream>

using namespace std;

int factorial(int n);
int fibonacci(int n);
int triangularNumber(int n);
char getChoice();           //Only allow selections of 'A,' 'B,' 'C,' & 'Q'
int getNum();               //Only allow positive numbers to be input

int main()
{
    int n;
    char answer;
    do
    {
        answer = getChoice();
        if(answer != 'Q')
            n = getNum();
        switch(answer)
        {
            case 'A': cout << "The factorial of " << n << " is "
                        << factorial(n) << "." << endl;
                       break;
```

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        case 'B': cout << "The " << n << "th Fibonacci number is "
                    << fibonacci(n) << "." << endl;
                break;
        case 'C': cout << "The " << n << "th triangular number is "
                    << triangularNumber(n) << "." << endl;
                break;
    }
}while(answer != 'Q');
return 0;
}
//Do not change any of this!!!

```