

Lab 5

Instructions: Use recursive functions to implement a countdown, calculate the factorial of an integer, and calculate the number of digits in an integer.

Objectives:

- Explore recursion.
- Identify base/recursive cases in recursive tasks
- Implement recursive functions.

Task: Implement the following functions in a C program called `Lab5.c`. **All repeated behaviors should be accomplished using recursion. Loops are not allowed.**

- `void countDown(int t)`: Given some initial time `t`, prints a countdown from `t` down to 1.
Example:

◦ `countDown(5)` → Prints "5 4 3 2 1".

- `int factorial(int x)`: Returns the factorial of x , where the factorial $x!$ is defined as follows:

$$x! = x * (x - 1) * (x - 2) * \dots * 1$$

Examples:

- `factorial(3)` → $3*2*1 = 6$
- `factorial(5)` → $5*4*3*2*1 = 120$

- `int numDigits(int x)`: Returns the number of digits in x . Examples:
 - `numDigits(1)` → 1
 - `numDigits(11)` → 2
 - `numDigits(44444)` → 5

In the `main` function, use `scanf` to prompt the user for different inputs, then print the results of the three functions as shown in Figure 1.

```

/home/user/CIS190/Lab5/$ ./Lab5.out
Count down from: 5
5      4      3      2      1
Factorial of: 3
3! = 6
Number of digits of: 123
numDigits(123) = 3
/home/user/CIS190/Lab5/$ ./Lab5.out
Count down from: 10
10     9     8     7     6     5     4     3     2     1
Factorial of: 5
5! = 120
Number of digits of: 123456
numDigits(123456) = 6

```

Figure 1. Example outputs for Lab5.c.

Hints:

- When implementing the recursive functions above, consider the following:
 - **Base case:** For what input(s) (t or x) does the task *end*? What should be done/returned at this final step?
 - **Recursive case:** For what inputs does the task not end, and must continue? What should be done/returned at these intermediate steps?
 - **Recursive call:** In the recursive case, a recursive call (a repeated call to the same function) is used to continue the algorithm. How should the recursive call differ from the previous call to ensure that the algorithm eventually reaches the base case(s)?

Submission details:

- Upload a compressed archive (e.g., .zip) containing Lab5.c.
- The archive should be named Lab5_LastName, where LastName is your last name.
- If you're on Linux, you can use the following command to create a .tar.gz archive from the terminal:

```
$ tar -czvf Lab5_LastName.tar.gz Lab5.c
```

where LastName is your last name.