CSE 232 Spring 2016

Programming Project 03

This assignment is worth 30 points (3% of the course grade) and must be **completed and turned in before 11:59 on Monday, February 8th , 2016.**

Assignment Overview

This assignment will give you more experience on the use of loops and conditionals, and introduce the use of functions.

Background

There are all sorts of special numbers the math researchers and hobbyists have discovered. One such class of numbers is called *Narcissistic Numbers* of a particular order. The basic idea is this. If we take each individual digit of an integer number, raise that digit to a particular power (the order of the narcissistic number), then add all those exponentiated numbers together, a narcissistic number should give back the original number. For example, 153 is an order 3 narcissistic number because: $1^3 + 5^3 + 3^3 = 153$. You can look at the Wolfram Math page (http://mathworld.wolfram.com/NarcissisticNumber.html) for more examples of such numbers.

Pseudo-Narcissitic Numbers

In fact, we are ***only sort of doing*** Narcissistic Numbers(NN). A real NN requires that the power/order be the same as the number of digits in the number. So if 153 is a NN, it should have a power/order of 3. There are numbers that are the sum of some power of their digits where the power is not the count of their digits. For example, 4150 is the sum of its order 5 digits, that is $4^5 + 1^5 + 5^5 + 0^5 == 4150$. Not technically an NN since the power is 5, not 4 (the digit count), but we will count it anyway.

We will write some functions to test that we can generate all the narcissistic numbers in a particular range and a selected order.

Project Description / Specification

Warning

First, a warning. In this and in all future projects we will provide *exactly* our function specifications: the function name, its return type, its arguments and each argument's type. The functions will be tested independent of the main program you provide. If you do not follow the function specifications, these independent tests of your functions will fail. Do not change the function declarations!

function: `order_parameters`: return is `void`. Arguments are two integers `first` and `second` passed by reference. If the first is greater than second, then the two numbers should be swapped.

function: `narc_num`: return is `bool`. Arguments are two integers: `num` and `power`. Return is `true` if `num` is a narcissistic number of order `power`. False otherwise.

function `check_range`: return is `int`, the number of NN's found in the given range.
Arguments are 3 integers `first`, `last` and `power`. Arguments are interpreted as:

  - `first`, the first number in the range of numbers to be checked
  - `last`, the last number in the range of numbers to be checked (inclusive)
  - `power`, the power (order) of the narcissistic number
- Check the numbers in the range from `first` to `last` inclusive.
- Calls `narc_num` on each number in the range.

- If a number is narcissistic (for example, 153), prints out the following:

```
153 is a narcissistic number of order:3
```

function `main`: return is `int`. No arguments.

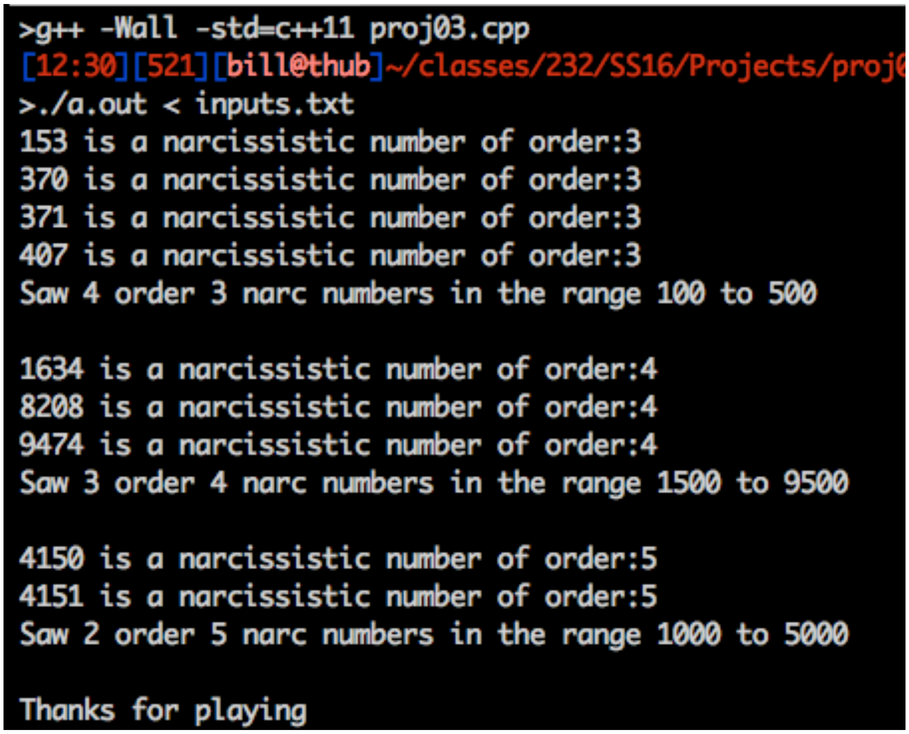
- As with the previous projects, the program will be tested using re-directed input from the console. An `inputs.txt` file is provided (see the sample below)
- Read in the number of cases you want to check
- For each case, three numbers representing:
    - o `first`, beginning of the range
    - o `last` end of the range
        - ▪ Calls `order_parameters` to get `first` and `last` in the correct order (`first` should be smaller than `last`).
    - o The `order` to be checked
    - For each case call `check_range`.
    - At the end of each case, print the number of NN's found in the range

Deliverables

`proj03.cpp` -- your source code solution (*remember to include your section, the date, project numberand comments in this file*).

1) Be sure to use “proj03.cpp” for the file name (or handin might not accept it!)
2) Save a copy of your file in your CS account disk space (H drive on CSE computers). This is the only way we can check that you completed the project on time in case you have a problem with handin.
3) Electronically submit a copy of the file.

Sample output using provided inputs.txt:



```
>g++ -Wall -std=c++11 proj03.cpp
[12:30][521][bill@thub]~/classes/232/SS16/Projects/proj
>./a.out < inputs.txt
153 is a narcissistic number of order:3
370 is a narcissistic number of order:3
371 is a narcissistic number of order:3
407 is a narcissistic number of order:3
Saw 4 order 3 narc numbers in the range 100 to 500

1634 is a narcissistic number of order:4
8208 is a narcissistic number of order:4
9474 is a narcissistic number of order:4
Saw 3 order 4 narc numbers in the range 1500 to 9500

4150 is a narcissistic number of order:5
4151 is a narcissistic number of order:5
Saw 2 order 5 narc numbers in the range 1000 to 5000

Thanks for playing
```

Notes:

- a sample `inputs.txt` file is provided. It includes a mis-ordered begin and end range
- you can write as many functions are you like over and above the ones I have specified.
- make sure you write the requested functions exactly as specified. They will be tested individually according to that specification.

Attack/identify the different subproblems in the description. For example:

- write the function for `order_parameters`. Write a `main` to confirm that it works
- write the function for `narc_num`. Confirm it
- etc.