Introduction to Programming, PIC10A
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UCLA

Homework 3
Due 5pm, Monday, April 23, 2017

Submit `palindrome.cpp` for problem 1 and `collatz.cpp` for problem 2.

Problem 1: (Palindrome)

A *palindromic number* or *numeral palindrome* is a number that remains the same when its digits are reversed. Write a program that checks whether a nonnegative integer is a palindromic number. The input and output should be exactly:

```
Input a nonnegative integer:
[USER ENTERS A NONNEGATIVE INTEGER]
```

followed by

```
X is a palindromic number.
```

or

```
X is not a palindromic number.
```

where `X` is the integer provided by the user. You may not use any libraries aside from `iostream`. Name your file `palindrome.cpp`.

Hint. The code

```
int i = 4578;
int j;
for (j = i; (j/10) > 0; j /= 10) ;
cout << j << endl;
```

extracts the leading digit `4`. (This code is written cryptically and in poor style for pedagogical purposes. Please don't write code this way.)

Problem 2: (Collatz conjecture)

Given a positive integer, perform the following operations each step:

- If the number is even, divide it by two.
- If the number is odd, triple it and add one.

The Collatz conjecture states that you will always reach 1. Write a program that computes how many steps it takes to reach 1 starting from a positive integer. The input and output should be exactly

```
Input a positive integer:
[USER ENTERS A POSITIVE INTEGER]
Starting from X.
Step 1: X
Step 2: X
...
Step X: X
Starting from X, it took X steps.
```

For example, if you input 19, the output should be

```
Input a positive integer:
19
Starting from 19.
Step 1: 58
Step 2: 29
Step 3: 88
Step 4: 44
Step 5: 22
Step 6: 11
Step 7: 34
Step 8: 17
Step 9: 52
Step 10: 26
Step 11: 13
Step 12: 40
Step 13: 20
Step 14: 10
Step 15: 5
Step 16: 16
Step 17: 8
Step 18: 4
Step 19: 2
Step 20: 1
Starting from 19, it took 20 steps.
```

If you input 1, the output should be

```
Input a positive integer:
1
Starting from 1.
Step 1: 4
Step 2: 2
Step 3: 1
Starting from 1, it took 3 steps.
```

You may not use any libraries aside from `iostream` and `string`. Name your file `collatz.cpp`.