# *COMP 208: Computers in Engineering*

# *Winter, 2016*

# *Assignment 2: Backwards and Forwards*

## Due Date

Assignment 2 is due on Thursday, February 11 at 23:59. The cutoff is automated and is exactly at this time. Assignments submitted within the next hour will be considered late. After that time they will not be accepted at all.

The assignment is to be done individually. You can collaborate on understanding the problem but you must write the solutions independently. Submissions might be subject to being checked by plagiarism detection software.

## Introduction

Mathematicians often study integers with specific properties. One such property is that of being a palindrome. A palindromic number (in base 10) is a non-zero number which reads the same backwards and forwards when written in base 10. For example 10322301 is a palindromic number.

It is easy to check that there are 9 palindromic numbers less than 10, 18 less than 100, 108 less than 1000, 198 less than 100, etc. We would like to examine the frequency of distribution of such numbers empirically. (It is not that difficult to come up with an analytic formula for this).

A surprising result is that the sum of the reciprocals of the palindromic numbers actually converges to a constant, approximately 3.37018. It is this property that we will study in this assignment.

## Assignment

You are to write a C program to study the sum of the reciprocals of the palindromic numbers.

Your program input some upper limit of values to examine. It should then go through the numbers from 1 up to this limit. You should count the number of palindromic numbers you find and compute the sum of their reciprocals.

You would like to output: the number of values processed, the number of palindromes found and the sum of their reciprocals.

However for large values of limit this would produce too many lines of output. Therefor you should only output 10 lines. Only output these values when the counter is a multiple of limit/10.

If limit is 9765, your output should look like:

```
976  105  3.315968
1952  117  3.325508
2928  127  3.329747
3904  137  3.332714
4880  146  3.334793
5856  156  3.336685
6832  166  3.338276
7808  176  3.339647
8784  186  3.340853
9760  195  3.341827
```

If the value of limit is 10000000, your output should look like:

```
1000000  1998  3.367469
2000000  2998  3.368162
3000000  3998  3.368568
4000000  4998  3.368855
5000000  5998  3.369078
6000000  6998  3.369261
7000000  7998  3.369415
8000000  8998  3.369548
9000000  9998  3.369666
10000000  10998  3.369772
```

## Methodology

You will have to be able to check whether a number is palindromic. You should make sure you are able to do this before trying to develop the entire program. If you get this part correct you will receive at least half marks for the assignment.

The program can consist of a loop that goes through all the numbers up to the specified limit. For each number it must check whether or not it is a palindrome. If it is, count it and add its reciprocal to the sum of reciprocals.

## Requirements

- The program must be written in C
- Use meaningful variable names
- Comment and indent your code. It is your responsibility to make it readable to the grader
- Submit only the source file (.f90) and name your file A2_123456789 where 1234567898 is replaced by your student ID number.