

COL100 Lab

First set of challenge questions:

Q1. a) Write a program to approximate a real cube root of a given number using the bisection method. Input : N : an integer. Output : C : a real number closer to a real cube root of N.

b) Modify your program to approximate a real Kth root of a given number. Input : N, K (both are integers). Output : C : (a real number closer to a real kth root of n). Test your program (b) for k=2,3,4

References : Bisection method : https://en.wikipedia.org/wiki/Bisection_method

Nth root : https://en.wikipedia.org/wiki/Nth_root

Q2. What will be the output of the following snippet of code when run?

```
int a = 2;
```

```
float b = 2;
```

```
float c = 3;
```

```
int d = 3;
```

```
printf("%d %f &d &f %d %f %d %f", a/c, a/c, a/d, a/d, b/c, b/c, b/d, b/d);
```

(Hint: Try writing a C program to do this)

Q3. Write a simple C program to find the sum of all multiples of 3 and 5 below 2000. (Hint: The answer can be verified by hand!)

Q4. Suppose you start writing a C program at time T1 (hh:mm:ss). At time T2 (hh:mm:ss) coding is finished. After compiling code, you get an error, and it took you T3 (hh:mm:ss) time to fix the error. Write a program to find the total time you spent in developing this program. Note that the inputs T1, T2, T3 will be given in hh:mm:ss format (e.g. 01:30:57) in the same line.

Q5. Starting with the number 1 at the center and moving to the right in a clockwise direction a 5 by 5 spiral is formed as follows:

21	22	23	24	25
20	7	8	9	10
19	6	1	2	11
18	5	4	3	12
17	16	15	14	13

It can be verified that the sum of the numbers on the diagonals is 101. What is the sum of the numbers on the diagonals in a 1001 by 1001 spiral formed in the same way?

Q6. If we take 47, reverse and add, $47 + 74 = 121$, which is palindromic. Not all numbers produce palindromes so quickly. For example,

$$349 + 943 = 1292,$$

$$1292 + 2921 = 4213$$

$$4213 + 3124 = 7337$$

That is, 349 took three iterations to arrive at a palindrome.

Although no one has proved it yet, it is thought that some numbers, like 196, never produce a palindrome. A number that never forms a palindrome through the reverse and add process is called a Lychrel number. Due to the theoretical nature of these numbers, and for the purpose of this problem, we shall assume that a number is Lychrel until proven otherwise. In addition you are given that for every number below ten-thousand, it will either (i) become a palindrome in less than fifty iterations, or, (ii) no one, with all the computing power that exists, has managed so far to map it to a palindrome. In fact, 10677 is the first number to be shown to require over fifty iterations before producing a palindrome: 4668731596684224866951378664 (53 iterations, 28-digits).

Surprisingly, there are palindromic numbers that are themselves Lychrel numbers; the first example is 4994.

Write a program to find how many Lychrel numbers (according to the above definition) are there below ten-thousand.

Q7. Write a program to take the input from the standard input. The task is to scan the input and draw the following two histograms:

- 1) A histogram of the different lengths of words present in its input.
- 2) A histogram of different frequencies of different characters in its input.

Tips:

- a) First try to draw the histogram in the horizontal orientation, i.e, Make the bars of the histogram horizontal. You can use any characters like (+, #, *, %, etc) to draw a unit of bar.
- b) You can also try to draw it in the vertical orientation, i.e, Make the bars of the histogram vertical. Doing this part would be more challenging than the horizontal orientation.

Q8. Write code to swap two integer variables in C without using a third temporary variable.