Computing Laboratory

Programming in C – Warmup

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Problems – Day 1

1. Suppose you are playing a game in turn with the computer. Total n number of sticks are to be picked up in this game. Whoever picks the last one loses the game. Neither the computer nor you can pick up more than 3 sticks at a time. Nobody can skip a turn, i.e. at least one stick is to be picked up in a turn. Write a program to let the following happen.
   i) The computer wins if it has the first turn.
   ii) The computer wins optimally irrespective of the turn.
2. An n-digit number is `SPECIAL` if the addition of its sum of the digits and the product of its digits equals to the original number. E.g., 19 is a `SPECIAL` 2-digit number. Write a program to verify whether a given number is `SPECIAL` or not. Extend this program to verify whether there exists any `SPECIAL` number for a given value of number of digits n.

Problems – Day 1

3. Write a program to verify whether an input matrix is square or not. If it is not a square matrix, print `NOT SQUARE`. Otherwise, further check whether it is singular (determinant is 0) or unimodular (determinant is 1). Accordingly, print `SQUARE - SINGULAR` or `SQUARE - UNIMODULAR`, otherwise print `SQUARE - OTHER`.
4. Let us define a string, comprising English alphabets, as `NICE` if each vowel within it are equidistant from its successor and predecessor vowel, if applicable. E.g., "rhythm", "cool", "malayalam" are `NICE` strings. Write a program to verify whether a given string is `NICE` or not. You are required to take the string as a direct input without asking for its length.

Problems – Day 1

5. Define a structure for representing complex numbers. Using this definition, write a function that takes three real numbers, a, b and c as input, and returns the two roots of the quadratic equation $ax^2 + bx + c = 0$. Finally, compute the ratio of the two roots obtained. Recall that, for dividing two complex numbers, you need to multiply the numerator and denominator by their complex conjugates and then simplify.
6. Suppose there are two separate files each of which contains a sufficiently large integer value. Write a program that will take those two filenames as command line arguments and return the result of their summation.
   Note: An efficient implementation will not depend on the primary memory of the system.

Problems – Day 1

7. You have to write a program that reads its own source file (i.e., mtc19xx-day1-prog5.c), and prints the lines in that file in lexicographically sorted order. The output of your program should be identical to the output of the command "sort mtc19xx-day1-prog6.c". Recall that, given any two strings s and t, the function `strcmp()` may be used to determine the lexicographic ordering of s and t.
   Note: An efficient implementation is highlighted below.