

# 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

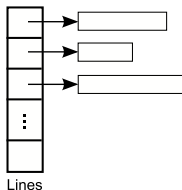
- 5 Define a structure for representing complex numbers. Using this definition, write a function that takes three real numbers,  $a$ ,  $b$  and  $c$  as input, and returns the two roots of the quadratic equation  $ax^2 + bx + c = 0$ . Finally, compute the ratio of the two roots obtained. Recall that, 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.

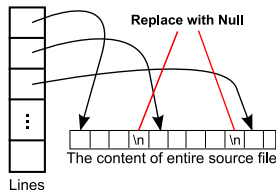
# Problems – Day 1

- 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.



Naive approach



Efficient approach