Heriot-Watt University

Mathematical And Computer Sciences (MACS) School

Programming Competition 2019

Write a set of programs, in one or more programming languages of your choice, for the following problems. Please create a folder and call it "MACS_Competition", then create a subfolder for each question. Answer the questions in the order you like. Marks are rewarded for working and efficiently coded programs. Your program should be able to correctly react to any input from the user. Also note that the other inputs will also be tried apart for the examples given in the questions.

You may use up to two hard-copy general programming books. No access to Internet or any other form of documentation is allowed.

PLEASE TURN OFF YOUR MOBILE.

ALL THE BEST

Problem 1.

Caesar cipher took its name from Julius Caesar who used it while writing letters to Cicero. Interesting thing is that this code was still used in 1915 by the Russian army because only such a simple cipher seemed understandable for staff officers.

The cipher works as follows:
Each letter from an decrypted text is changed to another letter from the Latin alphabet. According to the rule it has to be the third letter on the right from the one we want to encrypt. Thus the letter A is encrypted as D, letter B as E, etc. The letter Z is changed to C. In order to decrypt the text we repeat the operation by moving letters by three positions to the left. In your program you will consider the no of characters to shift. For instance in the example below it is 3 "ABC MN" to produce the output DEF PQ

$List.Index(x) = Num$

$In\ List[Num] = Item$
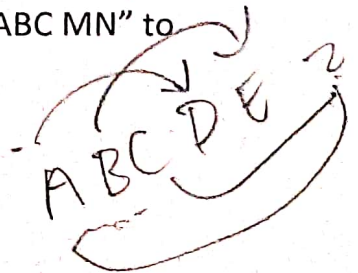
Problem 3.

Magic number 6174 : Kaprekars Constant : Write a program that takes a 4-digit number with at least two distinct digits. Your program should perform the following routine on the number: Arrange the digits in descending order and in ascending order (adding zeroes to fit it to a 4-digit number), and subtract the smaller number from the bigger number. Then repeat the previous step. Performing this routine will always cause you to reach a fixed number: 6174. Then performing the routine on 6174 will always give you 6174 (7641 - 1467 = 6174). Your program should return the number of times this routine must be performed until 6174 is reached. For example: if 3524 is the input than your program should return 3 because of the following steps: (1) 5432 - 2345 = 3087, (2) 8730 - 0378 = 8352, (3) 8532 - 2358 = 6174.

Input: 2111

Output: 5

while s

Input: 9831

Output: 7

Problem 4.

Write a program that takes a string parameter, which will contain single digit numbers, letters, and question marks, and check if there are exactly 3 question marks between every pair of two numbers that add up to 10. If so, then your program should return the string true, otherwise it should return the string false. If there aren't any two numbers that add up to 10 in the string, then your program should return false as well.
For example: if str is "arrb6???4xxbl5???eee5" then your program should return true because there are exactly 3 question marks between 6 and 4, and 3 question marks between 5 and 5 at the end of the string.

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Input:"aa6?9"

Output:"false"
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for x in range (len, string):

for string off string x = int: