

INDIAN STATISTICAL INSTITUTE

MTech(CS) I year 2025-2026

Subject: Computing Laboratory

Practice Problem Set I

Q1. Write a program to count the number of occurrences of each letter A-Z or a-z in the input. The input may span **multiple lines**. While counting letters, **do not distinguish** between uppercase and lowercase letters. Ignore all non-letter characters, e.g., digits, punctuation, spaces and tabs. You should print, in alphabetical order, only the letters that actually occur in the input, along with their counts (≥ 1).

Sample input:

```
C           Programming
is      not      fun!!
```

Sample output:

```
a 1
c 1
f 1
g 2
i 2
m 2
n 3
o 2
r 2
s 1
t 1
u 1
p 1
```

Q2. Run-length encoding (RLE) is a form of lossless data compression in which runs of data (consecutive occurrences of the same data value) are stored as a single occurrence of that data value and a count of its consecutive occurrences, rather than as the original run. For example, the run-length encoded form of `aaabccd` is `a3bc2d`.

- Write a program to convert a given string s , consisting of at most 100 letters (lower / upper case), to s' , its *run-length encoded* form. This means that s' will contain the same sequence of distinct characters as s , but any $m > 1$ consecutive occurrences of a character will be replaced by a single occurrence of the character immediately followed by the integer m (in base 10).
- Write a program to decode a given run-length encoded string s' to its original form s . For example, given `Aa3bC2d`, your program should print `AaaabCCd`. Similarly, given `abcd`, your program should print `abcd` itself; given `z10`, your program should print `zzzzzzzzzz`.

Q3. Recall that a permutation π of the integers $[n] \triangleq \{0, 1, 2, \dots, n-1\}$ may be represented by an array A of length n , by setting $A[i] = \pi(i)$. Write a C program which, given n and a list A of space-separated integers, determines

(a) whether A represents a permutation π of $[n]$, and

(b) prints π^{-1} in the same format if the answer to the above question is YES.

Sample input 1: 10 2 7 4 9 8 3 5 0 6 1

Sample output 1: 7 9 0 5 2 6 8 1 4 3

Explanation: The first number in the input (10) specifies that the rest of the input should be a permutation of $0, 1, 2, \dots, 9$. Since this is indeed the case, the output should be the inverse permutation. Observe, for example, that $\pi(0) = 2, \pi(1) = 7, \pi(2) = 4$ and so on. If π' denotes the second permutation, then $\pi'(2) = 0, \pi'(4) = 2, \pi'(7) = 1, \dots$. Thus, $\pi' = \pi^{-1}$.

Sample input 2: 4 1 2 3 4

Sample output 2:

Explanation: No output is printed, because the first integer in the input (4) specifies that the rest of the input should be a permutation of $[4] = \{0, 1, 2, 3\}$.

Q4. The International Standard Book Number (ISBN) is a 10-digit code of the form $d_{10}d_9d_8d_7 \dots d_2d_1$ that uniquely specifies a book. The rightmost digit d_1 is a *checksum digit* that must be chosen to satisfy the following condition:

$$d_1 + 2d_2 + 3d_3 + \dots + 10d_{10} \equiv 0 \pmod{11}$$

Note that the checksum digit d_1 can range from 0 to 10 (inclusive); if $d_1 = 10$, it is represented as X.

Write a C program that reads a 9-digit integer, computes the checksum digit, and prints the full 10-digit ISBN.

Sample input: 020131452

Sample output: 0201314525

Explanation: The correct checksum digit is 5, since:

$$5 + 2 \cdot 2 + 3 \cdot 5 + 4 \cdot 4 + 5 \cdot 1 + 6 \cdot 3 + 7 \cdot 1 + 8 \cdot 0 + 9 \cdot 2 + 10 \cdot 0 = 88 \equiv 0 \pmod{11}$$