

Q12. Code Breaking Challenge (60 marks)

Dena is known for her expertise in deciphering complex codes. She has been assigned a top-secret project that presents her with a challenge — breaking a cryptic code composed of a number string.

The cryptic code, denoted as S , consists of N decimal digits. Dena discovers crucial rules to decipher the code during her investigation: (1) the deciphered code consists of the similar digits as that of the cryptic code, but the digits may be in different sequence; (2) the deciphered code must not contain the “01” substring to unravel the hidden message within. Her primary objective is to break the cryptic code by obtaining a modified string that eliminates all occurrences of “01” substring.

Leveraging her knowledge of code-breaking techniques, Dena further realizes that strategic swaps of adjacent digits hold the key to remove the occurrences of substring “01” from the cryptic number string. For example, a cryptic number string “301” can be transformed with a swap of the second and third digits to make it into “310” to eliminate the occurrence of “01”. Minimizing the number of swaps required to eliminate the “01” substrings becomes imperative, as it allows Dena to break the code quickly and unravel the hidden message within.

For example, consider a scenario where $N = 5$ and the initial code string S is “70010”.

By swapping the third and fourth digits, the code string transforms into “70100”.

Subsequently, by swapping the second and third digits, the code string transforms into “71000”.

With the above processes, remarkably, the modified code string no longer contains the “01” substring, aligning with Dena’s decoding objective.

In this case, Dena successfully breaks the code by performing a minimum of 2 swaps.

Write a programme to**Input, in sequence:**

An integer N denoting the length of the cryptic code (number string), where $1 \leq N \leq 50$;

A cryptic code (number string), S , which consists of N digits.

Output:

The minimum number of swaps required to obtain a modified code string without the “01” substring.

试题 12. 密码破解挑战 (60 分)

迪娜以破解复杂密码而闻名，她被分配到了一个绝密的任务——破解由数字串组成的神秘密码。

这个神秘密码可用 S 表示，由 N 个十进制数字组成。在调查过程中，迪娜发现了破解密码的关键规则：(1) 破解后的密码与神秘密码由相同的数字所组成，但其顺序可能不同；(2) 破解后的密码不能包含子数字串"01"，以解开隐藏在其中的信息。迪娜的主要目标是通过消除神秘密码里所有子数字串"01"，从而获得一个修改后的数字串来破解神秘密码。

凭借她对密码破解技术的了解，迪娜进一步意识到了策略性的交换相邻数字是消除神秘密码中子数字串"01"的关键。例如，神秘数字串"301"可以通过交换第二位和第三位数字变成"310"，从而消除"01"的出现。如此一来，尽量减少所需的交换次数以消除所有子数字串"01"变得非常重要，因为这样可以让迪娜快速破解密码并解开其中隐藏的信息。

例如，考虑 $N = 5$ ，同时初始密码数字串 S 为"70010"。

通过交换第三位和第四位数字，密码数字串可变为"70100"。

接着，通过交换第二位和第三位数字，密码数字串可变为"71000"。

值得注意的是，经过过程后，修改过的数字串不再包含子数字串"01"，这也达到了迪娜解码的目标。

在上述情况下，迪娜成功地通过了最少的 2 次交换来破解了密码。

试写一程式以**依序输入：**

一个正整数 N ，以表示神秘密码（数字串）的长度，其中 $1 \leq N \leq 50$ ；

一个由 N 个数字所组成的神秘密码（数字串） S 。

输出：

消除子数字串"01"所需的最小交换次数，以获得修改后的密码数字串。

Examples (例子)

Input (输入)	Output (输出)
5 70010	2
8 00134001	3
20 01010001020103111001	8
40 2101314151617181912131415161711181912131	1
22 0110101101019110102111	14

Test Cases:

Input (输入)	Output (输出)
5 70010	2
8 00134001	3
20 01010001020103111001	8
40 2101314151617181912131415161711181912131	1
22 0110101101019110102111	14
38 91110000000000111115001100011100001111	40
50 11210062000011011901111016300110000090411111101000	11
46 0100111011919010011101191901001101191901001110	28