Homework Assignment #5: Programming Exercise #1

Note

This assignment constitutes 4% of your grade and is due 2:10PM Tuesday, April 9, 2013. Please write/type your answers/code on A4 (or similar size) paper. Drop your homework by the due time in Yih-Kuen Tsay's mail box on the first floor of Management College Building II. Late submission will be penalized by 20% for each working day overdue. You may discuss the problems with others, but copying answers/code is strictly forbidden.

Your work will be graded according to its correctness and presentation. Specifically, you should provide evidences showing that your program is correct. You should also organize and document your program in such a way that other programmers, for example your classmates, can understand it. **Some of you may be requested to demonstrate your program.**

Problem

Solve Problem D "Fibonacci Words" of the 2012 Annual ACM International Collegiate Programming Contest World Finals (see the appended).

Please prepare an input file with more interesting cases and test your program on the input. In the documentation of your program, you should describe how you have applied the algorithmic techniques, in particular design by induction, learned in class.

Problem D
Fibonacci Words
Problem ID: fibonacci

The Fibonacci word sequence of bit strings is defined as:

$$F(n) = \begin{cases} 0 & \text{if } n = 0 \\ 1 & \text{if } n = 1 \\ F(n-1) + F(n-2) & \text{if } n \geq 2 \end{cases}$$

Here $+$ denotes concatenation of strings. The first few elements are:

n	$F(n)$
0	0
1	1
2	10
3	101
4	10110
5	10110101
6	1011010110110
7	10110101101101010110101
8	1011010110110101101011011010110110
9	10110101101101011010110110101101101011010110110101101

Given a bit pattern p and a number n, how often does p occur in $F(n)$?

Input

The first line of each test case contains the integer n ($0 \leq n \leq 100$). The second line contains the bit pattern p. The pattern p is nonempty and has a length of at most 100 000 characters.

Output

For each test case, display its case number followed by the number of occurrences of the bit pattern p in $F(n)$. Occurrences may overlap. The number of occurrences will be less than 2^{63}.

Sample Input	Output for Sample Input
6 10 7 10 6 01 6 101 96 10110101101101	Case 1: 5 Case 2: 8 Case 3: 4 Case 4: 4 Case 5: 7540113804746346428