Code Jam 2015 - World Finals

Pretty Good Proportion

Problem

I have a sequence of **N** binary digits. I am looking for a substring with just the right proportion of 0s and 1s, but it may not exist, so I will settle for something that's just pretty good.

Can you find a substring where the fraction of 1s is as close as possible to the given fraction **F**? Output the earliest possible index at which such a substring starts.

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each one starts with a line containing **N** and **F**. **F** will be a decimal fraction between 0 and 1 inclusive, with exactly 6 digits after the decimal point. The next line contains **N** digits, each being either 0 or 1.

Output

For each test case, output one line containing "Case #x: y", where x is the test case number (starting from 1) and y is the 0-based index of the start of the substring with the fraction of 1s that is as close as possible to **F**. If there are multiple possible answers, output the smallest correct value.

Limits

Memory limit: 1 GB.
$1 \le \mathbf{T} \le 100$.
$0 \le \mathbf{F} \le 1$
F will have exactly 6 digits after the decimal point.

Small dataset

Time limit: 240 seconds.
$1 \le \mathbf{N} \le 1000$.

Large dataset

Time limit: 480 seconds.
$1 \le \mathbf{N} \le 500{,}000$.

Sample

Sample Input

```
5
12 0.666667
001001010111
11 0.400000
10000100011
9 0.000000
```

Sample Output

```
Case #1: 5
Case #2: 5
Case #3: 5
Case #4: 0
Case #5: 6
```

```
111110111
5 1.000000
00000
15 0.333333
000000000011000
```

In Case #1, there is no substring that has exactly a 1-proportion of exactly 666667/1000000. The closest we can get is 2/3. The input string has 5 substrings that achieve it -- 3 substrings of length 3 that start at indices 5, 7, and 8 (101, 101, and 011); as well as two substrings of length 6 that start at indices 5 and 6 (101011 and 010111). The smallest of these indices is 5.