A - Exchange

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 300 points

Problem Statement

In Japan, there are six types of coins in circulation: 1 yen, 5 yen, 10 yen, 50 yen, 100 yen, and 500 yen. Answer the following question regarding these coins.

> Mr. AtCoder's wallet contains A 1-yen coins, B 5-yen coins, C 10-yen coins, D 50-yen coins, E 100-yen coins, and F 500-yen coins.
>
> He is planning to shop at N stores in sequence. Specifically, at the i-th store $(1 \leq i \leq N)$, he plans to buy one item that costs X_i yen (including tax).
>
> Giving and receiving change takes time, so he wants to choose his coins so that he can pay the **exact amount** at each store. Determine if this is possible.

Constraints

- $0 \leq A \leq 200$
- $0 \leq B \leq 200$
- $0 \leq C \leq 200$
- $0 \leq D \leq 200$
- $0 \leq E \leq 200$
- $0 \leq F \leq 200$
- $1 \leq N \leq 10$
- $1 \leq X_i \leq 10000 \ (1 \leq i \leq N)$
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
A \quad B \quad C \quad D \quad E \quad F \\
N \\
X_1 \quad X_2 \quad \cdots \quad X_N
\end{array}
$$

Output

Print `Yes` if the objective is achievable, and `No` otherwise.

Sample Input 1

```
0 0 6 3 4 1
3
700 250 160
```

Sample Output 1

```
Yes
```

For example, he can make exact payments at all three stores as follows:

- At the first store: Use two 100-yen coins and one 500-yen coin.
- At the second store: Use five 10-yen coins and two 100-yen coins.
- At the third store: Use one 10-yen coin and three 50-yen coins.

Sample Input 2

```
0 0 0 2 4 0
3
100 200 300
```

Sample Output 2

```
No
```

The total amount in the wallet is 500 yen, but a total payment of $100 + 200 + 300 = 600$ yen is required, so it is impossible to purchase all the items.

Sample Input 3

```
0 0 0 0 8 8
1
250
```

Sample Output 3

```
No
```

There are no 50-yen or smaller coins in the wallet, so it is impossible to pay exactly 250 yen.

Sample Input 4

```
20 5 9 7 10 6
5
177 177 177 177 177
```

Sample Output 4

```
Yes
```

Sample Input 5

```
17 5 9 7 10 6
5
177 177 177 177 177
```

Sample Output 5

```
No
```

B - Puzzle of Lamps

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score: 400 points

Problem Statement

Mr. AtCoder has created a device consisting of N small light bulbs arranged in a row from left to right, and two switches A and B. Each light bulb can be in one of two states: `0` (OFF) and `1` (ON). Pressing each switch causes the following:

- Pressing switch A turns the leftmost light bulb in the `0` state into `1`.
- Pressing switch B turns the leftmost light bulb in the `1` state into `0`.

If there is no applicable light bulb, you cannot press the switch.

Initially, all light bulbs are in the `0` state. He wants the states of the light bulbs to be $S_1, S_2, \dots, S_N$ from left to right. Determine the order and number of times the switches should be pressed to achieve this. It is not necessary to minimize the number of presses, but it should be at most 10^6 so that the operations can finish in a realistic time. It can be proved that a solution exists under the constraints of this problem.

Constraints

- $1 \leq N \leq 30$
- Each of $S_1, S_2, \dots, S_N$ is `0` or `1`.
- Not all of $S_1, S_2, \dots, S_N$ are `0`.
- N is an integer.

Input

The input is given from Standard Input in the following format:

N
$S_1 S_2 \dots S_N$

Note that the second line is given as a string of length N.

Output

If your solution presses the switches m times $(1 \leq m \leq 10^6)$ in the order $t_1, t_2, \ldots, t_m$ (each being `A` or `B`), print those in the following format:

$$m$$
$$t_1 t_2 \ldots t_m$$

The second line should be printed as a string of length m.

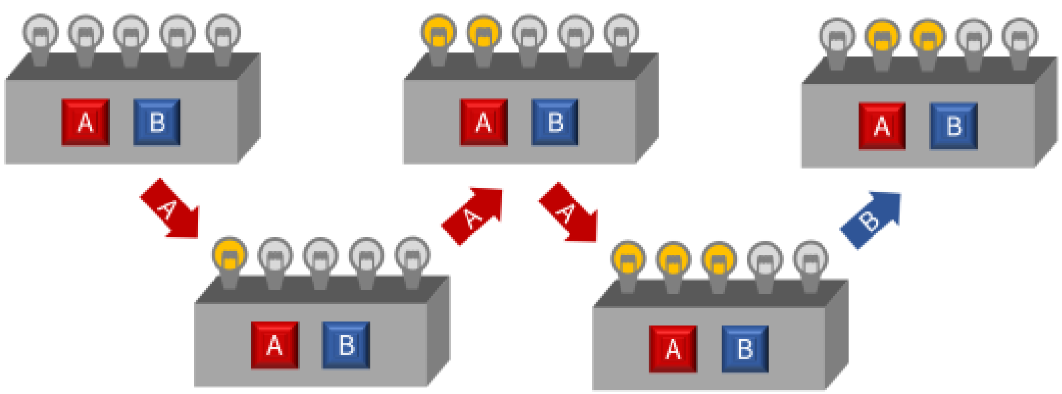
Sample Input 1

```
5
01100
```

Sample Output 1

```
4
AAAB
```

This sample output presents a solution that presses the switches in the order A, A, A, B. This sets the light bulbs to the desired states, as shown in the figure below:



Alternatively, pressing switches in the order A, A, B, A, A, B also sets the light bulbs to the desired states. The following output corresponding to this solution would also be accepted:

```
6
AABAAB
```

C - Routing

Time Limit: 2.5 sec / Memory Limit: 1024 MiB

Score: 500 points

Problem Statement

There is a grid with N rows and N columns. Let (i, j) $(1 \leq i \leq N, 1 \leq j \leq N)$ denote the cell at the i-th row from the top and the j-th column from the left. Each cell is initially painted red or blue, with cell (i, j) being red if $c_{i,j} =$R and blue if $c_{i,j} =$B. You want to change the colors of some cells to purple so that the following two conditions are simultaneously satisfied:

> **Condition 1**: You can move from cell $(1, 1)$ to cell (N, N) by only passing through cells that are red or purple.
> **Condition 2**: You can move from cell $(1, N)$ to cell $(N, 1)$ by only passing through cells that are blue or purple.

Here, "**You can move**" means that you can reach the destination from the starting point by repeatedly moving to a horizontally or vertically adjacent cell of the relevant colors.

What is the minimum number of cells that must be changed to purple to satisfy these conditions?

Constraints

- $3 \leq N \leq 500$
- Each $c_{i,j}$ is R or B.
- $c_{1,1}$ and $c_{N,N}$ are R.
- $c_{1,N}$ and $c_{N,1}$ are B.
- N is an integer.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
c_{1,1}c_{1,2}\cdots c_{1,N} \\
c_{2,1}c_{2,2}\cdots c_{2,N} \\
\vdots \\
c_{N,1}c_{N,2}\cdots c_{N,N}
\end{array}
$$

Output

Print the answer.

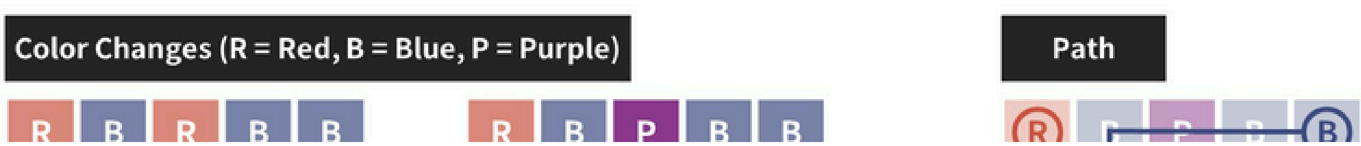
Sample Input 1

```
5
RBRBB
RBRRR
RRRBR
RBBRB
BBRBR
```

Sample Output 1

```
3
```

As shown in the figure below, changing cells $(1, 3)$, $(3, 2)$, $(4, 5)$ to purple satisfies the conditions.



Sample Input 2

```
5
RBBBB
BBBBB
BBBBB
BBBBB
BBBBR
```

Sample Output 2

```
7
```

As shown in the figure below, changing cells $(1,2),(2,2),(2,3),(3,3),(3,4),(4,4),(4,5)$ to purple satisfies the conditions.

Sample Input 3

```
10
RRBBBBBBBB
BRRBBBBBBB
BBRRBBBBBB
BBBRRBBBBB
BBBBRRBBBB
BBBBBRRBBB
BBBBBBRRBB
BBBBBBBRRB
BBBBBBBBRR
BBBBBBBBBR
```

Sample Output 3

```
2
```

Sample Input 4

```
17
RBBRRBRRRRRBBBBBB
BBRBRBRRBRRBRRBBR
BRBRBBBRBBRBBRBBB
RBRRBBBBBBRRBRRRR
RRRRRBRBRRRBBRBBR
RRRRRBRRBRBBRRRBB
BBBRRRBRBRBBRRRBB
BBRRRBRBBBRBRRRBR
RRBBBBBBBBBBBRBRR
RRRBRRBRBRBRBRBBB
RRBRRRRBRBRRBRBBR
RRRBBRBRBBBRBBRBR
BBRBBRRBRRRBBRBBB
BBBRBRRRRRRRBBRBB
RRRRRBRBRBBRRBRRR
BRRRRBBBRRRBRRBBB
BBRRBBRRRBBBRBBBR
```

Sample Output 4

```
8
```

D - Earthquakes

Time Limit: 2.5 sec / Memory Limit: 1024 MiB

Score: 700 points

Problem Statement

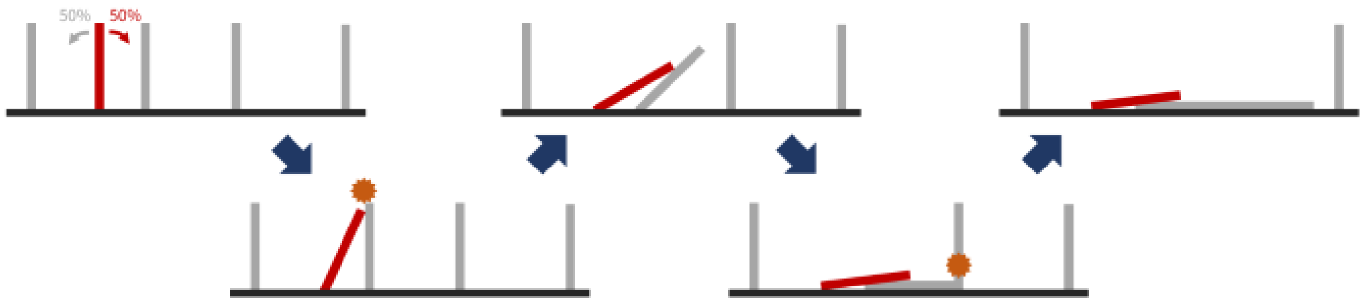
AtCoder Street is a road represented by a straight line on flat ground. There are N utility poles of height H standing on this road. The poles are numbered $1, 2, \ldots, N$ in chronological order. Pole i ($1 \leq i \leq N$) is vertically positioned at coordinate X_i. **The base of each pole is fixed to the ground.** Assume that the poles are sufficiently thin.

The street will experience N earthquakes. During the i-th earthquake $(1 \leq i \leq N)$, the following events occur:

1. If pole i has not yet fallen, it falls to the left or the right on the number line, each with a probability of $\frac{1}{2}$.
2. If a falling pole collides with another pole that has not yet fallen (including collision at the base of the pole), the latter pole will also fall in the same direction. This may trigger a chain reaction.

The direction in which a pole falls during step 1 is independent of the direction in which other poles have fallen.

The following figure is an example of how poles might fall during one earthquake:



For earthquake preparedness, for each $t = 1, 2, \ldots, N$, find the probability that all poles have fallen by exactly the t-th earthquake. Multiply it by 2^N and print the result modulo 998244353. It can be proved that the values to be printed are integers.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq H \leq 10^9$
- $0 \leq X_i \leq 10^9$ $(1 \leq i \leq N)$
- $X_1, X_2, \ldots, X_N$ are all distinct.
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \quad H \\
X_1 \quad X_2 \quad \cdots \quad X_N
\end{array}
$$

Output

Print the answers for $t = 1, 2, \ldots, N$ in this order, separated by spaces.

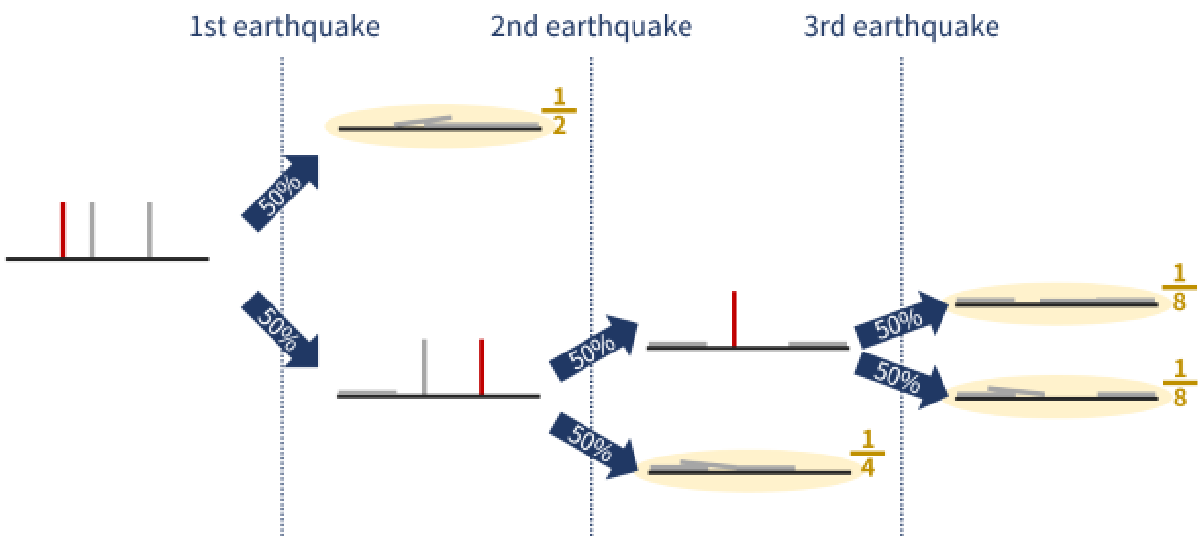
Sample Input 1

```
3 2
0 3 1
```

Sample Output 1

```
4 2 2
```

The following figure shows the possible ways the poles can fall for this sample input. The fractions in the figure indicate the probability of each state occurring.



Therefore, the probabilities that all poles have fallen by exactly the 1-st, 2-nd, 3-rd earthquakes are $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{4}$, respectively. Multiply these by 8 to get $4, 2, 2$ for output.

Sample Input 2

```
4 10
10 55 20 45
```

Sample Output 2

```
0 4 4 8
```

The following figure shows the possible ways the poles can fall for this sample input. The fractions in the figure indicate the probability of each state occurring.

Therefore, the probabilities that all poles have fallen by exactly the 1-st, 2-nd, 3-rd, 4-th earthquakes are 0, $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{2}$, respectively. Multiply these by 16 to get $0, 4, 4, 8$ for output.

Sample Input 3

```
8 1
5 0 6 3 8 1 7 2
```

Sample Output 3

```
0 64 32 48 24 28 28 32
```

The probabilities that all poles have fallen by exactly the 1-st, 2-nd, 3-rd, 4-th, 5-th, 6-th, 7-th, 8-th earthquakes are 0, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{3}{32}$, $\frac{7}{64}$, $\frac{7}{64}$, $\frac{1}{8}$, respectively.

Sample Input 4

```
40 20
695 793 11 502 114 861 559 4 212 609 894 435 429 94 91 258 161 45 33 605 673 634 629 163 283 826 409 8
4 507 548 31 248 588 340 357 168 926 949 322 912
```

Sample Output 4

```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 41942627 41942627 360709869
```

Not all poles will have fallen by the 37-th earthquake. The probabilities that all poles have fallen by exactly the $38, 39, 40$-th earthquakes are $\frac{3}{8}$, $\frac{3}{8}$, $\frac{1}{4}$, respectively.

E - Wrong Scoreboard

Time Limit: 9 sec / Memory Limit: 1024 MiB

Score: 1000 points

Problem Statement

In the AtCoder World Tour Finals 2800, N contestants participated, and a total of five problems were presented. Each problem is assigned an integer score of at least 1 point, and the problems are numbered so that the scores are **non-decreasing** from problem 1 to problem 5. There are no partial points. Similar to the usual AtCoder rules, ranking is done as follows. **In this problem, we do not consider the situation where multiple contestants have the same total score and penalty.**

▶ Ranking

Now, Aoki, a reporter covering the finals, noted the following information:

1. The number of participants N.
2. Which problems each contestant solved. $A_{i,j} = 1$ means the i-th contestant $(1 \le i \le N)$ correctly solved problem j, and $A_{i,j} = 0$ means they did not.
3. The rank of each contestant. The i-th contestant $(1 \le i \le N)$ was ranked R_i-th.

However, when he started writing the article, he realized he did not note the scores and penalties. Furthermore, he realized there might be inconsistencies in the information he noted. Now, solve the following problem.

> Assume that he correctly noted information 1 and 2. Let D_i be the actual rank of contestant i $(1 \le i \le N)$, and find the minimum possible total squared error $(D_1 - R_1)^2 + (D_2 - R_2)^2 + \cdots + (D_N - R_N)^2$.

You have T test cases to process.

Constraints

- $1 \le T \le 10^5$
- $2 \le N \le 3 \times 10^5$
- Each of $A_{i,1}, A_{i,2}, A_{i,3}, A_{i,4}, A_{i,5}$ is 0 or 1 $(1 \le i \le N)$.
- The sum of $A_{i,1}, A_{i,2}, A_{i,3}, A_{i,4}, A_{i,5}$ is at least 1 $(1 \le i \le N)$.
- $1 \le R_i \le N$ $(1 \le i \le N)$
- $R_1, R_2, \dots, R_N$ are distinct.
- The total value of N across all test cases is at most 3×10^5.
- All input values are integers.

Input

The input is given from Standard Input in the following format. Here case_i represents the i-th test case $(1 \le i \le T)$.

$$
\begin{aligned}
&T \\
&\mathrm{case}_1 \\
&\mathrm{case}_2 \\
&\vdots \\
&\mathrm{case}_T
\end{aligned}
$$

Each test case is given in the following format:

$$
\begin{aligned}
&N \\
&A_{1,1} \quad A_{1,2} \quad A_{1,3} \quad A_{1,4} \quad A_{1,5} \\
&A_{2,1} \quad A_{2,2} \quad A_{2,3} \quad A_{2,4} \quad A_{2,5} \\
&\vdots \\
&A_{N,1} \quad A_{N,2} \quad A_{N,3} \quad A_{N,4} \quad A_{N,5} \\
&R_1 \quad R_2 \quad \cdots \quad R_N
\end{aligned}
$$

Output

Print the answers.

Sample Input 1

```
6
4
0 1 1 0 0
1 0 0 1 0
1 1 0 1 0
1 0 1 0 0
1 2 3 4
8
0 1 0 0 0
1 1 0 1 0
0 1 1 0 1
1 0 0 0 0
1 1 0 1 0
0 1 0 0 0
0 0 0 1 0
0 1 1 1 1
7 4 2 8 3 6 5 1
6
1 1 0 0 0
0 0 1 0 0
1 1 1 0 0
0 0 0 1 0
1 1 1 1 0
0 0 0 0 1
1 2 3 4 5 6
6
1 1 0 0 0
0 0 1 0 0
1 1 1 0 0
0 0 0 1 0
1 1 1 1 0
0 0 0 0 1
6 5 4 3 2 1
20
0 0 0 0 1
0 0 1 0 0
1 1 0 0 1
1 0 1 0 1
0 0 0 1 1
0 0 1 1 1
1 1 1 1 0
1 1 0 1 0
0 0 1 1 0
1 0 1 0 0
0 1 0 0 1
0 1 1 1 1
1 1 1 1 1
0 1 0 1 0
1 0 0 0 1
1 1 1 0 0
0 1 1 1 0
```

```
0 0 0 1 0
1 1 1 0 1
1 1 0 1 1
7 18 3 5 19 11 13 2 4 10 14 15 17 6 16 9 8 12 1 20
15
0 0 1 1 0
0 0 0 1 0
0 0 0 0 1
0 0 1 1 1
1 1 0 0 1
0 1 1 1 0
1 1 1 1 1
0 1 1 0 1
1 1 0 1 0
1 0 0 1 1
1 0 1 0 0
1 1 0 1 1
0 1 0 1 0
1 1 0 0 0
0 1 0 0 1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

Sample Output 1

```
6
0
26
0
1054
428
```

This input contains six test cases. Let us explain the first one.

Consider the following scenario.

- Problems $1, 2, 3, 4, 5$ have $100, 500, 800, 900, 1300$ points, respectively.
- Contestants $1, 2, 3, 4$ have penalties of $90, 80, 70, 60$ minutes, respectively.

Then, the ranking will be as shown in the table below, where the total squared error is $(2-1)^2 + (3-2)^2 + (1-3)^2 + (4-4)^2 = 6$. There is no way to make the total squared error 5 or less, so the answer is 6.

Contestant	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5	Total score	Penalty	Rank
Contestant 1	-	500	800	-	-	1300	90 minutes	2nd
Contestant 2	100	-	-	900	-	1000	80 minutes	3rd
Contestant 3	100	500	-	900	-	1500	70 minutes	1st
Contestant 4	100	-	800	-	-	900	60 minutes	4th

Now, let us explain the second test case.

Consider the following scenario.

- Problems $1, 2, 3, 4, 5$ have $1000, 1400, 2000, 2000, 2718$ points, respectively.
- Contestants $1, 2, \ldots, 8$ have penalties of $295, 286, 242, 236, 277, 288, 187, 299$ minutes, respectively.

Then, the ranking will be as shown in the table below. For every $i\ (1 \leq i \leq N)$, the rank of contestant i is R_i, so the total squared error is 0.

Contestant	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5	Total score	Penalty	Rank
Contestant 1	-	1400	-	-	-	1400	295 minutes	7th
Contestant 2	1000	1400	-	2000	-	4400	286 minutes	4th
Contestant 3	-	1400	2000	-	2718	6118	242 minutes	2nd
Contestant 4	1000	-	-	-	-	1000	236 minutes	8th
Contestant 5	1000	1400	-	2000	-	4400	277 minutes	3rd
Contestant 6	-	1400	-	-	-	1400	288 minutes	6th
Contestant 7	-	-	-	2000	-	2000	187 minutes	5th
Contestant 8	-	1400	2000	2000	2718	8118	299 minutes	1st

F - Two Airlines

Time Limit: 5 sec / Memory Limit: 2048 MiB

Score: 1000 points

Problem Statement

The Republic of AtCoder consists of $L+1$ islands aligned east-west, numbered 0 to L from west to east. The islands are connected by air routes, where for each $1 \leq i \leq L$, there is a bidirectional air route between islands $i-1$ and i, as shown in the figure below. Each air route is owned by company A or company J, and the route between islands $i-1$ and i is owned by company S_i.

The nation has N residents, numbered 1 to N. Resident i is currently on island X_i.

Each resident has a **coupon** of one of the companies. Specifically, resident i has a coupon of company C_i. With a coupon, a resident can take that company's routes for free **any number of times**, but taking a route of the other company costs 1 coin per trip.

Now, there is a treasure chest on island 0. The residents want to cooperate to carry it to the capital, which is on island L. Determine the minimum total number of coins required to achieve this goal.

The residents can pass the treasure chest to each other, but not their coupons.

Constraints

- $1 \leq L \leq 6 \times 10^4$
- $1 \leq N \leq 6 \times 10^4$
- $S_i \ (1 \leq i \leq L)$ is `A` or `J`.
- $0 \leq X_i \leq L \ (1 \leq i \leq N)$
- $C_i \ (1 \leq i \leq N)$ is `A` or `J`.
- L, N, and X_i are integers.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
L \quad N \\
S_1 S_2 \cdots S_L \\
X_1 \quad C_1 \\
X_2 \quad C_2 \\
\vdots \\
X_N \quad C_N
\end{array}
$$

Note that the second line is given as a string of length L.

Output

Print the answer.

Sample Input 1

```
4 3
AAJJ
3 A
1 J
1 J
```

Sample Output 1

```
2
```

The following procedure carries the treasure chest to island 4 for a total of 2 coins.

1. Resident 1 moves from island 3 to island 2. The route is not covered by the coupon, so 1 coin is paid.
2. Resident 1 moves from island 2 to island 1. The route is covered by the coupon, so no coin is needed.
3. Resident 1 moves from island 1 to island 0. The route is covered by the coupon, so no coin is needed.
4. Resident 1 picks up the treasure chest.
5. Resident 1, carrying the treasure chest, moves from island 0 to island 1. The route is covered by the coupon, so no coin is needed.
6. Resident 1 passes the treasure chest to resident 2.
7. Resident 2, carrying the treasure chest, moves from island 1 to island 2. The route is not covered by the coupon, so 1 coin is paid.
8. Resident 2, carrying the treasure chest, moves from island 2 to island 3. The route is covered by the coupon, so no coin is needed.
9. Resident 2, carrying the treasure chest, moves from island 3 to island 4. The route is covered by the coupon, so no coin is needed.

Sample Input 2

```
8 3
JJAAJJAJ
2 A
6 A
8 J
```

Sample Output 2

```
6
```

Sample Input 3

```
8 6
JJAAJJAJ
2 A
6 A
8 J
8 J
8 J
8 J
```

Sample Output 3

```
4
```