BUET INTER-UNIVERSITY PROGRAMMING CONTEST
PROBLEM I – INKED CARPETS

Problem

2011 is really a very special year. The last and true Sultan on Earth is going to be married. What can be more delightful than the marriage ceremony of our beloved Sultan? As a part of the reception, the Sultan and his bride will walk side by side on the royal passage which consists of **L** unit length cells. The cells are numbered by **1, 2, …, L**. Many photographers and distinguished guests are coming to cover this event, so Sultan orders his manager to cover the whole passage with beautifully colored carpets.

His manager found that the shop provides best quality carpets of different colors denoted by positive integers from **1** to **M** and they fit exactly from cell **Start** to cell **End**, inclusive. For example, if a carpet fits from cell 2 to 4, it cannot be used to cover cell 1 to 3 (though the length is equal) or to cover 2 to 3 (A carpet cannot be used partially). The carpets cannot be overlapped, i.e. if carpets which can cover 1 to 3 and 2 to 6 are available, both of them cannot be used simultaneously. The manager has to minimize the cost of covering the whole passage. If he buys 3 consecutive (when they are placed on the passage; see NOTE) segments of same color, he will get a discount of **Minimum(D, cost of 3rd carpet)** from the shop.

Moreover, the manager has infinite colorless carpets which can be used for any cell and any number of times, but he must paint it with a color but this is not counted for discount (see NOTE). The costs of coloring this carpet with different colors are known. Now, if the change of color in consecutive segments is very frequent, the Sultan will not like it. So, among multiple selections of different carpets with the minimum cost, he has to minimize the total number of color changes. A color change occurs if two consecutive segments have different colors.

Input

First line of input contains a positive integer **T** $(1 \leq T \leq 120)$ which is the number of test cases. For each case, the first line contains **4** integers, **L, N** (no. of different carpets), **M** and **D** (amount of discount). $(1 \leq L, D \leq 10^9, 1 \leq N \leq 10^3, 1 \leq M \leq 50)$ The next line contains **M** positive integers, where **i-th** integer denotes the cost of coloring unit length of the colorless carpet with **i-th** color. Each of the next **N** lines contains **4** positive integers, **Start, End, color** and **price** of **i-th** carpet. $(1 \leq start \leq end \leq L \ and \ 1 \leq price \leq 10^9)$

Output

For each of the cases output "Case x: y z" in a separate line, where **x** is case number, **y** is the minimum cost and **z** is the minimum number of color changes in the selection of carpets with the minimum cost.

Sample Input	Output for Sample Input
``` 2 7 3 2 5 1 3 1 2 1 1 5 6 1 2 5 7 2 2 6 2 2 3 2 2 ```	``` Case 1: 5 1 Case 2: 9 0 ```

1 2 1 5 3 6 2 5	

Explanation of Sample Cases

In the 1st case, we can use colorless carpet for the whole passage and color that with the 1st color. This will create a cost of 7 and 0 color changes. For minimum cost, we need to use carpet 1 and carpet 3. We can use colorless carpet to cover 3 to 4 and color it with color 1. That will create a cost of $1 + 1*2 + 2 = 5$ and no. of color change will be 1(from 1 to 2 in cell 4 to cell 5).

In the 2nd case, we have to use 2nd carpet to get the minimum cost. For covering cell 1 to cell 2, we can use the colorless carpet and color it with any color for the minimum cost. To minimize color change, we need to color it with color 2. Then total cost = $2*2 + 5 = 9$ and no. of color change will be 0.

Note

The rule of discount can be understood from the following scenario:

Say, the manager uses carpet of color 1 from cell 1 to cell 2 of price 10 and colorless carpet from cell 3 to cell 4 and colors it with color 1. Then he uses 4 carpets of color 1 from cell 5 to cell 6 of price 7, from cell 7 to cell 9 of price 3, from cell 10 to 11 of price 4 and from cell 12 to cell 15 of price 7 and the value of D is 5. Then he does not need to pay anything for cell 10 to 11. For cell 12 to cell 15, he needs to pay 2. He will not get any discount for other carpets. Say, the coloring cost of unit length with color 1 is 8.

The following table summarizes this scenario:

Start	End	Color or Type	Price	Discount	Final cost
1	2	1	10	0	10
3	4	Colorless (1)	0	0	$2*8 = 16$
5	6	1	7	0	7
7	9	1	3	0	3
10	11	1	4	Min (4,5) = 4	0
12	15	1	7	Min (5,7) = 5	2

Problemsetter: Anindya Das

Special Thanks: Hasnain Heickal Jami