



02 Hr 57 Min 48 Sec

Your Contest Ends At
2022-03-26 15:00:00 IST

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Mario 3

Problem Description

Imagine you are a video game developer. You are developing a game which requires the player to collect coins and cross hurdles. Let the character in your video game be called Mario. As Mario moves to collect coins and cross hurdles, the game keeps a count of relevant metrics. Write code to implement this flow.

Mario will run from left to right and jump from the ground in the air to collect coins or cross hurdles. The Game Screen will be provided as input in form of a matrix comprising of four characters viz {0, C, H and X}, where

0 - denotes empty space

C - denotes coins to be collected

H - denotes special type of hurdle to be crossed

X - denotes regular hurdle to be crossed

All coins are of the same type, whereas there are two types of regular hurdles - simple hurdle and ring hurdle. Simple hurdle is referred to as Hurdle hereafter.

A Hurdle always begins from the ground and a series of letter X stacked vertically make up the height of the hurdle.

A Ring Hurdle on the other hand, has a hole in it i.e., between X characters there will be exactly one hole denoted by 0 character. This hole is big enough for Mario to jump through it to cross that hurdle.

Now, let us understand how this information is provided in the input:

- The screen will be depicted in the input as a $M * N$ matrix. The index of rows and columns of this matrix begin from zero.
- The left bottom cell of this matrix is (0, 0). As we move right and up, the row and column indices increase
- Row zero is considered as Ground and anything above row zero is considered as Air
- Coins will always be in air, whereas hurdles will always manifest from the ground
- In order to jump, Mario needs to have a calorific budget. This jump can be for collecting coins or crossing hurdles
- For Jumping, one row worth of height, *JumpCalorie* worth of calories is required
- On obtaining one coin, Mario receives *CoinCalorie* worth of calories
- Game starts with Mario having an initial number of calories, *l*
- The game is over in one of the following conditions:
 - Either Mario crosses the grid and reaches the other end or
 - Mario falls short of calorific budget to either be able to collect coins or cross hurdles
- To collect coins Mario will jump vertically in the column where the coin is. Mario always jumps to the highest point where a coin is, on the screen. On his way down from that point, he grabs all coins lower in height in that column. Thus, one jump in one column is enough to fetch all the coins in that column
- Mario cannot jump and collect the lowest coin. He must always aim for the highest coin in that column
- Mario never jumps unless he must collect coins or cross a hurdle
- When crossing a ring hurdle, the calories consumed in clearing it is *JumpCalorie* * height of the hole in the ring hurdle. Refer the *Examples* section for better clarity
- When crossing a special hurdle (H), the following happens
 - Firstly, a column having H hurdle will not have any Coin C or regular hurdle X in the same column
 - Secondly, certain changes happen upon encountering odd-numbered and even numbered H hurdle as explained next.
 - When Mario encounters an odd-numbered H hurdle, following things happen in this exact sequence
 - First Mario tries to jump to the height where the H hurdle appears. Calories required for this is $\text{height} * \text{JumpCalorie}$
 - Next, when the H hurdle is crossed, Mario doubles in size. Hence, upon landing back on the ground, Mario's calorie budget is doubled
 - Until the next H hurdle, the *JumpCalorie* value is also doubled. Let's call this *JumpCalorie2*
 - Similarly, any coins collected from any subsequent columns before the next hurdle also earns Mario, 3X the value of the *CoinCalorie*. Let's call this *CoinCalorie3*
 - Things change again, upon encountering an even-numbered H hurdle
 - When Mario encounters an even-numbered H hurdle, following things happen in this exact sequence

1. First Mario tries to jump to the height where the H hurdle appears. Calories required for this is $\text{height} * \text{JumpCalorie} * 2$ (because Mario is currently double the original size.) or $\text{height} * \text{JumpCalorie}2$.
2. Next, when the H hurdle is crossed, Mario becomes his original size. Hence, upon landing back on the ground, Mario's calorie budget is halved
3. Until the next H hurdle, the *JumpCalorie* value remains the original value as mentioned in the input
4. Similarly, any coins collected from any subsequent columns before the next hurdle also earns Mario, the original value of *CoinCalorie* as mentioned in the input
5. Things toggle again, upon encountering an odd-numbered H hurdle

- Walking i.e., moving from one column to another, irrespective of Mario's size,
 - Consumes 1 calorie if, no coins are collected in the source column
 - Consumes 0 calories if, one or more coins are collected in the source column
 - Consumes 0 calories if, the source column crossed is an H column

Your task is to keep a track of the last column Mario has successfully crossed.

Consider the following as inputs along with a screen(grid) of size $5 * 10$:

Initial calorie: 5

JumpCalorie: 1

CoinCalorie: 2

0000000000

0CCC00H00X

0CCCHX0000

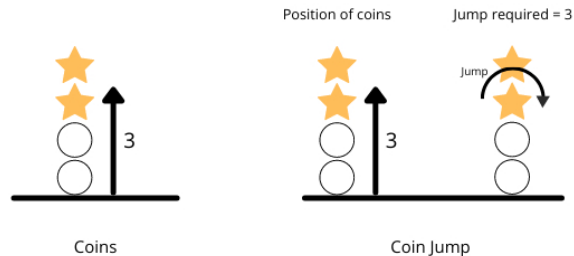
00000X0X0X

00000X0X0X

Column 0 is empty so Mario will only consume 1 calorie of energy. He was having 5 calories of energy initially, and after crossing the first column he will be left with 4 calories of energy.

It can be seen that we have coins on the screens in columns 1, 2 and 3.

Column : 1,2,3



The above two images describe the collection of coins and the energy spent in collecting them.

Column 1 has two coins at heights of 2 and 3 respectively. So, Mario will jump 3 units high and collect the highest coin. On his way down he will collect the coin at height 2. Total calories expended in collecting both coins in Column 1 is $3 * \text{JumpCalorie}$. Since, he has also collected two coins, his calorie count will be replenished by $2 * \text{CoinCalorie}$. Thus, Mario's calorie budget at the end of crossing column one is $[\text{Initial Calories} - 1 - (3 * \text{JumpCalorie}) + (2 * \text{CoinCalorie})]$.

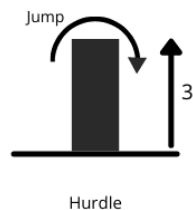
Similar calculations will apply to columns 2 and 3.

Substituting values of *JumpCalorie* and *CoinCalorie*, we get Mario's calorie budget equal to 7, after crossing column 3.

The fourth column has an H hurdle. Since this is the first H column, Mario's size will now double and so will the other values, as described in the *Problem Description* section. Mario must jump to the height of 2. Hence calorific budget will now be $7 - (2 * 1)$ i.e., 5. Upon landing on the ground, rewards will double. Hence the overall calorific budget at the end of processing column 4 is $5 * 2 = 10$.

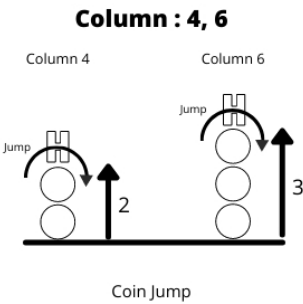
There is a hurdle at column 5 of height 3.

Column : 5



Mario is currently double his original size. Hence his calories expended will also be twice as large. Hence calorie count after crossing column 5 is: $10 - (2 * 2) = 6$

Mario is currently double his original size. Hence his calories expended will also be twice as large. Hence calorie count after crossing column 3 is, $10 - (2 * JumpCalorie(1) * 2) = 4$



The sixth column has an H hurdle. This is the second H hurdle. Mario must jump to the height of 3. Mario needs (height * JumpCalorie * 2 (currently double in size)) i.e., $(3 * 1 * 2) = 6$ calories. However, Mario has only 4 calories as his energy level. Hence, he can't cross the second H hurdle. In this case, the output will be 5 because last column successfully crossed is 5.

— Constraints

- $0 < I \leq 200$
- $0 < JumpCalorie < 10$
- $0 < CoinsCalorie < 10$
- $0 < M \leq 10$
- $10 \leq N < 100$

— Input

- First line contains an integer *I* which denotes the initial calorie count
- Second line contains an integer **JumpCalorie** which denotes the value by which calorie is expended per unit of height.
- Third line contains an integer **CoinsCalorie** which denotes the value by which calories are replenished per collected coin.
- Fourth line contains two space separated integers *M* and *N* which depict the size of grid (screen).
- Next *M* lines contain strings of size *N* characters comprised of 4 characters viz {0, C, H and X}.

— Output

- Output consists of two cases:
- If Mario is not able to cross the screen, print the last column number he has successfully crossed as output.
 - If Mario is able to cross the screen successfully, then print the calorie budget he is having after crossing the screen as output.

Note: If Mario has crossed *N* - 1 column which is the last column, and he is left with a calorie budget of 0 calorie. Print 0 as output because he has crossed the screen successfully.

— Time Limit (secs)

1

— Examples

Example 1

Input

5
1
2
5 10
000000000
0CCC00H00X
0CCCHX0000
00000X0X0X
00000X0X0X

Output

5

Explanation:

Explained in problem description section.

Example 2

Input

11

1

2

5 10

0000000000

0000000000

00H0000000

00000H0000

0000000000

Output

1

Explanation:

Given in the input specification, we have

Initial calorie count = 11

JumpCalorie: 1

CoinCalorie: 2

Screen size = $5 * 10$

0000000000

0000000000

00H0000000

00000H0000

0000000000

Following lines explain how Mario's calorie count changes as he moves across columns at the end of crossing a column

Calorie count after index 0 is 10

Calorie count after index 1 is 9

Changing size to double, at Height of h: 2, calorie count $*= 2$

Calorie count after index 2 is 14

Calorie count after index 3 is 13

Calorie count after index 4 is 12

Changing size to normal, at Height of h: 1, calorie count $/= 2$

Calorie count after index 5 is 5

Calorie count after index 6 is 4

Calorie count after index 7 is 3

Calorie count after index 8 is 2

Calorie count after index 9 is 1

After crossing the screen Mario is left with 1 calorie of energy. Hence, output is 1.

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☐ I, **Soumyadeep** confirm that the answer submitted is my own.

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