

Problem A

Phone List

Given a list of phone numbers, determine if it is consistent in the sense that no number is the prefix of another. Let's say the phone catalogue listed these numbers:

- Emergency 911
- Alice 97 625 999
- Bob 91 12 54 26

In this case, it's not possible to call Bob, because the central would direct your call to the emergency line as soon as you had dialled the first three digits of Bob's phone number. So this list would not be consistent.



Input specifications

The first line of input gives a single integer, $1 \leq t \leq 40$, the number of test cases. Each test case starts with n , the number of phone numbers, on a separate line, $1 \leq n \leq 10000$. Then follows n lines with one unique phone number on each line. A phone number is a sequence of at most ten digits.

Output specifications

For each test case, output "YES" if the list is consistent, or "NO" otherwise.

Sample input

```
2
3
911
97625999
91125426
5
113
12340
123440
12345
98346
```

Output for sample input

```
NO
YES
```

Problem B

Best Compression Ever

Being educated in Computer Science and Mathematics is not always easy. Especially not if you have “friends” who repeatedly insist on showing you their new “proofs” that P equals NP, that the Riemann Hypothesis is true, and so on.

One of your friends recently claims to have found a fantastic new compression algorithm. As an example of its amazing performance, your friend has told you that every file in your precious collection of random bit strings after compression would be at most b bits long! Naturally, you find this a bit hard to believe, so you want to determine whether it is even theoretically possible for this to be true.

Your collection of random bit strings consists of N files, no two of which are identical, and each of which is exactly 1000 bits long.



Input specifications

The input consists of two integers N ($1 \leq N \leq 10^{15}$) and b ($0 \leq b \leq 50$), giving the number of files in your collection and the maximum number of bits a compressed file is allowed to have.

Output specifications

Output a line containing either “yes” if it is possible to compress all the N files in your collection into files of size at most b bits, or “no” otherwise.

Sample input 1	Sample output 1
13 3	yes
Sample input 2	Sample output 2
1 0	yes
Sample input 3	Sample output 3
31415926535897 40	no

Problem C

Optimal Parking

When shopping on Long Street, Michael usually parks his car at some random location, and then walks to the stores he needs. Can you help Michael choose a place to park which minimises the distance he needs to walk on his shopping round?

Long Street is a straight line, where all positions are integer. You pay for parking in a specific slot, which is an integer position on Long Street. Michael does not want to pay for more than one parking though. He is very strong, and does not mind carrying all the bags around.



Input specifications

The first line of input gives the number of test cases, $1 \leq t \leq 100$. There are two lines for each test case. The first gives the number of stores Michael wants to visit, $1 \leq n \leq 20$, and the second gives their n integer positions on Long Street, $0 \leq x_i \leq 99$.

Output specifications

Output for each test case a line with the minimal distance Michael must walk given optimal parking.

Sample input

```
2
4
24 13 89 37
6
7 30 41 14 39 42
```

Output for sample input

```
152
70
```

Problem E

Event Planning

As you didn't show up to the yearly general meeting of the Nordic Club of Pin Collectors, you were unanimously elected to organize this years excursion to Pin City. You are free to choose from a number of weekends this autumn, and have to find a suitable hotel to stay at, preferably as cheap as possible.

You have some constraints: The total cost of the trip must be within budget, of course. All participants must stay at the same hotel, to avoid last years catastrophe, where some members got lost in the city, never being seen again.



Input specifications

The first line of input consists of four integers: $1 \leq N \leq 200$, the number of participants, $1 \leq B \leq 500000$, the budget, $1 \leq H \leq 18$, the number of hotels to consider, and $1 \leq W \leq 13$, the number of weeks you can choose between. Then follow two lines for each of the H hotels. The first gives $1 \leq p \leq 10000$, the price for one person staying the weekend at the hotel. The second contains W integers, $0 \leq a \leq 1000$, giving the number of available beds for each weekend at the hotel.

Output specifications

Output the minimum cost of the stay for your group, or "stay home" if nothing can be found within the budget.

Sample input 1	Sample output 1
3 1000 2 3 200 0 2 2 300 27 3 20	900

Sample input 2	Sample output 2
5 2000 2 4 300 4 3 0 4 450 7 8 0 13	stay home

Problem G

Getting Gold

We're building an old-school back-to-basics computer game. It's a very simple text based adventure game where you walk around and try to find treasure, avoiding falling into traps. The game is played on a rectangular grid and the player gets very limited information about her surroundings.



The game will consist of the player moving around on the grid for as long as she likes (or until she falls into a trap). The player can move up, down, left and right (but not diagonally). She will pick up gold if she walks into the same square as the gold is. If the player stands next to (i.e., immediately up, down, left, or right of) one or more traps, she will “sense a draft” but will not know from what direction the draft comes, or how many traps she's near. If she tries to walk into a square containing a wall, she will notice that there is a wall in that direction and remain in the position where she was.

For scoring purposes, we want to show the player how much gold she could have gotten safely. That is, how much gold can a player get playing with an optimal strategy and always being sure that the square she walked into was safe. The player does not have access to the map and the maps are randomly generated for each game so she has no previous knowledge of the game.

Input specifications

The first line of input contains two positive integers W and H , neither of them smaller than 3 or larger than 50, giving the width and the height of the map, respectively. The next H lines contain W characters each, giving the map. The symbols that may occur in a map are as follows:

- P – the player's starting position
- G – a piece of gold
- T – a trap
- # – a wall
- . – normal floor

There will be exactly one 'P' in the map, and the border of the map will always contain walls.

Output specifications

Output the number of pieces of gold the player can get without risking falling into a trap.

Sample input 1	Sample output 1
7 4 ##### #P.GTG# #..TGG# #####	1
Sample input 2	Sample output 2
8 6 ##### #...GTG# #..PG.G# #...G#G# #..TG.G# #####	4

Problem H

Shopaholic

Lindsay is a shopaholic. Whenever there is a discount of the kind where you can buy three items and only pay for two, she goes completely mad and feels a need to buy all items in the store. You have given up on curing her for this disease, but try to limit its effect on her wallet.



Shopaholics
Anonymous
 "Fashion fades, only style remains the same."
 -Coco Chanel

You have realized that the stores coming with these offers are quite selective when it comes to which items you get for free; it is always the cheapest ones. As an example, when your friend comes to the counter with seven items, costing 400, 350, 300, 250, 200, 150, and 100 dollars, she will have to pay 1500 dollars. In this case she got a discount of 250 dollars. You realize that if she goes to the counter three times, she might get a bigger discount. E.g. if she goes with the items that costs 400, 300 and 250, she will get a discount of 250 the first round. The next round she brings the item that costs 150 giving no extra discount, but the third round she takes the last items that costs 350, 200 and 100 giving a discount of an additional 100 dollars, adding up to a total discount of 350.

Your job is to find the maximum discount Lindsay can get.

Input specifications

The first line of input gives the number of test scenarios, $1 \leq t \leq 20$. Each scenario consists of two lines of input. The first gives the number of items Lindsay is buying, $1 \leq n \leq 20000$. The next line gives the prices of these items, $1 \leq p_i \leq 20000$.

Output specifications

For each scenario, output one line giving the maximum discount Lindsay can get by selectively choosing which items she brings to the counter at the same time.

Sample input

```
1
6
400 100 200 350 300 250
```

Output for sample input

```
400
```

Problem I

Moogle

You got the original idea of making map software, called Moogle Maps, for the new cool Maple mPhone. It will even be capable of indicating the location of a house address like "Main Street 13". However, since the mPhone has limited storage capacity, you need to reduce the data amount. You don't want to store the exact location of every single house number. Instead only a subset of the house numbers will be stored exactly, and the others will be linearly interpolated. So you want to select house numbers that will minimise the average interpolation error, given how many house locations you have capacity to store. We view the street as a straight line, and you will always store the first and the last house location.

Given that you've stored the locations x_i and x_j for the houses with numbers i and j respectively, but no other house in between, the interpolated value for a house with number k with $i < k < j$ is $x_i + (x_j - x_i) \cdot \frac{k-i}{j-i}$.



Input specifications

The first line of input gives a single integer, $1 \leq t \leq 50$, the number of test cases.

For each test case, there are two lines. The first contains $2 \leq h \leq 200$ and $2 \leq c \leq h$, where h is the number of houses in the street and c is the number of house locations that can be stored. The second contains h integers in increasing order giving the location of the h houses. Each location is in the interval $[0, 1000000]$.

Output specifications

For each test case, output the average interpolation error over all the h houses for the optimal selection of c house locations to store. The output should be given with four decimal places, but we will accept inaccuracies of up to ± 0.001 .

Sample input

```
2
4 3
0 9 20 40
10 4
0 10 19 30 40 90 140 190 202 210
```

Output for sample input

```
0.2500
0.3000
```