

TCPC 2017

**TUNISIAN COLLEGIATE
PROGRAMMING CONTEST**

ACM International Collegiate Programming Contest
The Fifth Tunisian Collegiate Programming Contest
Higher School of Communication of Tunis
March, 26th 2017



The ACM International Collegiate Programming Contest
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**ARAB COLLEGIATE
PROGRAMMING CONTEST**

The Fifth Tunisian Collegiate Programming Contest
(Contest Problems)

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Higher School of Communication of Tunis

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Tunis, Tunisia
March 2017

Problem A. ACPC Rush

Program: airport.(c|cpp|java)
Input: airport.in
Balloon Color: Red

Maha Ben Abdallah was getting ready to attend the Arab Regional contest ACPC2016 in Sharm El-Sheikh, Egypt. She was supposed to pack her bags the day before her flight but she got so busy at work that she couldn't manage to finish her plans in time. However, Maha is a very organised person, she has some boxes that she uses for packing and they are the same width and height as her travel bags. She had already put her important items in b boxes ($5 \leq b \leq 10$) that vary in length only. She also has ($1 \leq n \leq 3$) travel bags with different lengths ($40 \leq l_j \leq 80$) that she arranges her neat boxes inside.

Maha started to freak out about running out of time especially that she had a weight limit ($40 \leq w \leq 80$) for her ticket. She needed a fast optimized solution that would be the most efficient, and who could be better in finding such solutions than her best friend coach Fegla?!

She called him to save her and gave him her boxes' lengths l_i and the weight w_i of each of them, she also assigned a number p_i which represents how important each box is for her. She asked him to arrange the boxes in her travel bags in order to maximize the summation of the importance value of the taken boxes even if she had to leave some behind because of the weight limit on her ticket.

Can you help coach Fegla and Maha find the perfect combination for her travel baggage?

Input

The first line contains the number of test cases. Each test case starts with the number of travel bags ($1 \leq n \leq 3$), number of boxes ($5 \leq b \leq 10$), and the weight limit ($40 \leq w \leq 80$). Second line contains n numbers, the lengths ($40 \leq l_j \leq 80$) of each bag. b lines are followed and each line has three numbers ($5 \leq l_i \leq 40$), ($1 \leq w_i \leq 10$), and ($1 \leq p_i \leq 3$).

Output

For each test case, print a single integer on a single line: the summation of the importance value of boxes you choose to put in the bags so that weight limit, and bags dimensions are not violated.

Example

| airport.in | Standard Output |
|---|-----------------|
| 1 2 9 63 47 59 37 7 3 29 2 1 17 2 3 37 6 3 26 8 3 13 9 2 35 9 3 12 8 1 20 10 2 | 12 |

Problem B. Brookhaven Experiment

Program: brookhaven.(c|cpp|java)
Input: brookhaven.in
Balloon Color: Violet

The Tunisian dialect isn't easy to comprehend by Egyptians. Even though coach Fegla talks to Maha every day he still finds difficulty in certain words that she uses. One particular problem he has is with the word "yasser". In the Tunisian dialect, "yasser" means "too much" of something, and every time Maha uses it, things gets mixed up with coach and he thinks she is talking about a common friend they have whose name is Yasser. That's why we thought this problem must be about Yasser.

Yasser's place is really awesome, he has the coolest, scariest, and most entertaining games. It is the time to play the Brookhaven experiment. It is a VR horror game. You mount a VR gear on your head and use two controllers. In the Brookhaven experiment one controller is used as a gun, and the other is used as a flash light or a knife. There is a button you can use to alternate between knife and flash light.

In each level you are attacked by n zombies, one by one and you try to kill them, one by one as well. First, you try to kill a zombie with the gun. If you don't succeed, the zombie touches you, your life bar is affected by d damage, and you kill the zombie immediately with the knife.

Desoki, Yasser's friend, played the game before you and he killed m zombies before he died. It is your turn and we know your style of play, we can tell you the probability of killing each of the attacking zombies using the gun. Zombies attack you in a certain order. Zombie z_1 attacks you first, z_2 attacks you second, etc.. Also, for each zombie we tell you the damage d that each zombie can deal to your life bar l . Write code to calculate the expected value of killing at least m zombies before you are dead or all zombies are dead.

Input

You will be given the number of test cases T . Each test case consists of three lines. The first line contains three integers, the number of zombies ($1 \leq n \leq 1000$), your life bar ($1 \leq l \leq 1000$), and the number of zombies that Desoki has killed already ($1 \leq m \leq n$). The second line contains n numbers describing the probability of killing each zombie. ($0 \leq p_i \leq 1$) is the probability of killing the i^{th} zombie before touching you. The third line contains n numbers describing the damage d that each zombie deals to your life bar if they touch you. ($1 \leq d_i \leq 3$) is an integer the damage the i^{th} zombie can deal if they touch you.

Output

For each test case, print a single line consisting of a single number: the expected value of killing at least m zombies. The answer is considered correct if it is accurate to 9 decimal points.

Example

| brookhaven.in | Standard Output |
|---------------------------------------|-----------------|
| 3 | 3.886767487 |
| 4 4 3 | 1.000000000 |
| 0.563072 0.00998134 0.740844 0.574001 | 3.908520417 |
| 2 1 2 2 | |
| 1 3 1 | |
| 0.633404 | |
| 2 | |
| 4 4 3 | |
| 0.882368 0.805581 0.56017 0.508608 | |
| 2 2 1 1 | |

Problem C. Cool Stage

Program: `paint.(c|cpp|java)`
Input: `paint.in`
Balloon Color: `Green`

Maha was planning for the TCPC closing ceremony when she had a wonderful idea for the stage decoration. She drew N lines intersecting on the point of origin on the background of the stage and she asked one of the volunteers -who was a very good painter- to draw a different attraction from Tunisia in each segment between every two consecutive lines.

Maha needed to know how many drawings she should ask him to paint, so she wanted to count the number of angles generated from her decoration, given the number of lines N she drew, can you help Maha find out the answer?

Input

Your program will be tested on one or more test cases. The first line of the input contains a single integer ($1 \leq T \leq 100$) the number of test cases. Each test case consists of a single line containing the number of lines ($1 \leq N \leq 100$) Maha drew on the 2D plane.

Output

For each test case print a single line consisting of the number of angles generated from Maha's decoration idea.

Example

| paint.in | Standard Output |
|----------|-----------------|
| 1 | 2 |
| 1 | |

Problem D. Drag Racing

Program: `race.(c|cpp|java)`
Input: `race.in`
Balloon Color: `Orange`

Maha Ben Abdallah bought a brand new car. She was so excited about her car driving it around the streets of Tunisia until she became an expert driver and she fell in love with drag racing.

When coach Fegla visited her in Tunis he was impressed by how much her driving improved, she stopped yelling at the other drivers and was so happy to drive him around the country. He was enjoying the rides so much that he suggested that she must participate in the upcoming Drag Racing event in Tunisia.

This Drag Racing event has special rules, and because coach Fegla wants Maha to win so badly he decided to use his extraordinary Mathematics skills in order to guarantee her winning the race. In this race, the car speed at both start and finish points must be zero. And it's a Drag race which means Maha will be driving on a straight road until the end.

You will be given the car's top speed ($100 \leq s \leq 160$) mph, time ($3 \leq t_a \leq 6$) needed to accelerate from 0 to 60 mph, and time ($2 \leq t_d \leq 6$) needed to decelerate from 60 to 0 mph in seconds. Can you help coach Fegla calculate the minimum time needed to go from the start to end points of the race with this car, given that both start and end speeds must be zero?

Input

You will be given number of test cases ($T \leq 100$). For each test case you will be given ($100 \leq s \leq 160$) the car's top speed, ($3 \leq t_a \leq 6$) time needed to accelerate from 0 to 60 mph, ($2 \leq t_d \leq 6$) time needed to decelerate from 60 to 0 mph, and the distance ($100 \leq d \leq 6,000$) miles between start and finish points.

Output

Print one line for each test case consisting of the minimum time needed in seconds to arrive at the finish line at speed zero.

Example

| race.in | Standard Output |
|--------------------------|-----------------|
| 4 | 40.086219024 |
| 137 3.98499 2.77176 4435 | 38.825175000 |
| 150 3.67487 5.14527 4170 | 18.022219323 |
| 148 5.46721 4.39515 988 | 18.507904492 |
| 158 3.76598 3.30161 1454 | |

Note

Some equations you might need for this problem.

v : velocity

t : time

d : distance

v_f : final velocity

v_i : initial velocity

$$\begin{aligned} v &= \frac{d}{t} \\ a &= \frac{v}{t} \\ t &= \frac{v_f - v_i}{a} \Rightarrow 3.984 = \frac{60 - 0}{a} \Rightarrow a \\ d &= \frac{1}{2}at^2 \end{aligned}$$

Problem E. Entertaining the Teams

Program: photo.(c|cpp|java)
Input: photo.in
Balloon Color: Pink

Maha needed to take a group photo of all contestants and was thinking that them standing in a horizontal line, sorted non-descendingly from left to right by their height, would look cool. Lucky her, she found a list of the heights of the contestants to help her organize the gathering.

She and coach Fegla divided the contestants among unequal groups, gave each group an ID, and made sure each group was of the same height. Initially, the hall to take the photo in was empty, then coach Fegla would yell a group ID and the contestants of that group must enter the photo hall. Then, Maha would stand them in the line, making sure that the line is still sorted.

For some statistical benefit to him, every one in a while coach Fegla would need to know “Currently, what is the height of the K_{th} contestant from the left?”. Can you help him?

You’ll be given M queries of the form:

- $a\ H\ N$ - a group with height H and N just entered and stood in the line according to the correct order.
- $b\ K$ - print the K_{th} student’s height from the left.

Input

The first line of the input file contains a single number T ($1 \leq T \leq 128$) – the number of test cases.

The first line of each test case contains a single number M ($1 \leq M \leq 10^5$) – the number of queries. M lines follow, each will be on the form:

- $a\ H\ N$ – ($1 \leq H \leq 10^5$), ($1 \leq N \leq 10^{13}$).
- $b\ K$ – ($1 \leq K \leq C$), where C is the number of contestants currently in the line.

Output

For every query of the second type in each test case, print the required answer on a single line.

Example

| photo.in | Standard Output |
|----------|-----------------|
| 1 | 4 |
| 5 | 5 |
| a 4 7 | |
| a 3 9 | |
| b 11 | |
| a 5 5 | |
| b 17 | |

Problem F. Fegla's Birthday

Program: cake.(c|cpp|java)
Input: cake.in
Balloon Color: Yellow

Coach Fegla and Maha Ben Abdallah attended last year's Jordanian Collegiate Programming Contest JCPC2016. They worked so hard for many sleepless nights and after the contest ended they decided to take some time off and go for a few days to the Dead Sea to relax. Coach Fegla thought that they were going for a short vacation, but he never expected that Maha had a special plan for him all along, she had insisted on going to the dead sea in that time because it was coach Fegla's birthday and she wanted to surprise him on that special day!

Maha got him a huge cake and beautiful flowers, he was so excited by the surprise and how she worked so hard planning for it in a different country.

There was N people present during the birthday (including him and Maha). So, when coach Fegla was cutting his huge cake he decided to add his touch of problem solving to it. He wants to perform the minimum numbers of cuts needed to give at least a piece of cake to each person, given that each cut must be a straight line. Pieces don't have to be of equal sizes.

Input

Your program will be tested on one or more test cases. The first line of the input contains a single integer T ($1 \leq T \leq 10^4$) the number of test cases. Followed by T test cases.

Each test case consists of a single line which contains an integer N ($1 \leq N \leq 10^5$), the number of pieces needed.

Output

For each test case print a single line consisting of the minimum number of cuts required to be able to generate at least N pieces.

Example

| cake.in | Standard Output |
|---------|-----------------|
| 1 | 1 |
| 2 | |