BBP Formula

Time Limit: 16000/8000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 21 Accepted Submission(s): 12

Problem Description

In 1995, Simon Plouffe discovered a special summation style for some constants. Two year later, together with the paper of Bailey and Borwien published, this summation style was named as the Bailey-Borwein-Plouffe formula.Meanwhile a sensational formula appeared. That is

$$\pi = \sum_{k=0}^{\infty} \frac{1}{16^k}\left(\frac{4}{8k+1} - \frac{2}{8k+4} - \frac{1}{8k+5} - \frac{1}{8k+6}\right)$$

For centuries it had been assumed that there was no way to compute the n-th digit of π without calculating allof the preceding n - 1 digits, but the discovery of this formula laid out the possibility. This problem asks you to
calculate the hexadecimal digit n of π immediately after the hexadecimal point. For example, the hexadecimalformat of n is 3.243F6A8885A308D313198A2E ... and the 1-st digit is 2, the 11-th one is A and the 15-th one is D.

Input

The first line of input contains an integer T ($1 \le T \le 32$) which is the total number of test cases.
Each of the following lines contains an integer n ($1 \le n \le 100000$).

Output

For each test case, output a single line beginning with the sign of the test case. Then output the integer n, andthe answer which should be a character in $\{0, 1, \cdots, 9, A, B, C, D, E, F\}$ as a hexadecimal number

Sample Input

```
5
1
11
111
1111
11111
```

Sample Output

```
Case #1: 1 2
Case #2: 11 A
Case #3: 111 D
Case #4: 1111 A
Case #5: 11111 E
```

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Bridge

Time Limit: 4000/2000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 4 Accepted Submission(s): 2

Problem Description

Consider a 2 × n grid graph with nodes (x, y) where x ∈ {0, 1} and y ∈ {1, 2, · · · , n}. The initial graph has 3n - 2 edges connecting all pairs of adjacent nodes.
You need to maintain the graph with two types of different adjustments. The first one, denoted by "1 x_0 y_0 x_1 y_1",adds an new edge between the nodes (x_0, y_0) and (x_1, y_1) which was not exist. The second one, denoted by"2 x_0 y_0 x_1 y_1", erases an existed edge between the nodes (x_0, y_0) and (x_1, y_1).
It is sure that, for each adjustment, (x_0, y_0) and (x_1, y_1) were adjacent in the original grid graph. That is say thateither they share the same x coordinate and $|y_0 - y_1|$ = 1, or they share the same y coordinate and $|x_0 - x_1|$ = 1.
After each adjustment, we guarantee the connectedness of the graph and you need to calculate the number of bridges in the current graph.

Input

The first line of input contains an integer T (1 ≤ T ≤ 1001) which is the total number of test cases. For each test case, the first line contains integers n (1 ≤ n ≤ 200000) and m (0 ≤ m ≤ 200000); n indicates the size of the graph
and m is the number of adjustments. Each of the following m lines contains an adjustment described as above.
Only one case satisfies n + m ≥ 2000.

Output

For each test case, output m lines, each of which contains the number of bridges.

Sample Input

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

Sample Output

```
0
0
7
4
2
4
2
4
1
2
```

Empty Convex Polygons

Time Limit: 16000/8000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 39 Accepted Submission(s): 18

Problem Description

Given a set of distinct points S on a plane, we define a convex hole to be a convex polygon having any of thegiven points as vertices and not containing any of the given points in its interior. In addition to the vertices, other given points may lie on the perimeter of the polygon. We want to find a convex hole as above forming the convexpolygon with the largest area.

Input

This problem has several test cases.
The first line of input contains an integer t ($1 \le t \le 100$) indicating the total number of cases. For each test case,the first line contains the integer n ($3 \le n \le 50$). Each of the following n lines describes a point with two integers x and y where $-1000 \le x, y \le 1000$.
We guarantee that there exists at least one non-degenerated convex polygon.

Output

For each test case, output the largest area of empty convex polygon, with the precision of 1 digit.
Remark: The corollary of Pick's theorem about the polygon with integer coordinates in that says the area of it iseither ends to .0 or .5.

Sample Input

```
4
3
0 0
1 0
0 1
5
0 0
1 0
2 0
0 1
1 1
5
0 0
3 0
4 1
3 5
-1 3
6
3 1
1 0
2 0
3 0
4 0
5 0
```

Sample Output

```
0.5
1.5
17.0
2.0
```

Defense of the Ancients

Time Limit: 4000/2000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 0 Accepted Submission(s): 0

Problem Description

In the game of Defense of the Ancients, a team has n units and the other team has m towers. Each unit and towerhas some hit points (HP) and a fixed attack power (AP). The units (resp. towers) with positive HP are surviving and can attack the towers (resp. units), and the units (resp. towers) with zero HP are dead (resp. destroyed) andcannot attack anything.
The game is real-time and the time goes continuously. If a tower (resp. unit) is being attacked by k units (resp.towers) with the AP of $a_1, a_2, ..., a_k$ at the same time, then its HP will continuously decrease with the rate of $a_1 + a_2 + ... + a_k$ per second. There is no restriction on attack ranges. That is, any unit can attack any towers andvice versa.
During the whole game, the surviving units (resp. towers) will attack a selected tower (resp. unit) together untilit has been destroyed (resp. killed). That is, the surviving units (resp. towers) will focus to destroy (resp. kill) the towers (resp. units) one by one.
If all the units are killed and there is at least a surviving tower, the tower team wins. If all the towers are destroyed and there is at least a surviving unit, the unit team wins. If all the units are killed and all the towers are destroyed at the same time, the game ends in a tie.
Both teams play optimally. Your task is to predict the winner of the game.

Input

The first line is the number of test cases up to 10.
For each test case, there are 5 lines. The first line contains two integers n and m (0 < n ≤ 10^5, 0 < m ≤ 10^5).
The second line contains n integers, which are the HP of the units. The third line contains n integers, which are the AP of the units. The forth line contains m integers, which are the HP of the towers. The fifth line contains m integers, which are the AP of the towers.
All the HP and AP are positive and less than 2^32.

Output

For each test case, if the unit team has a winning strategy, output “Units win”, if the tower team has a winning strategy, output “Towers win”, if the game ends in a tie, output “Tie”.

Sample Input

```
3
1 1
10
10
9
11
2 2
1 1
5 4
2 1
4 2
3 3
1 2 3
1 4 9
1 4 9
1 2 3
```

Sample Output

```
Units win
Towers win
Tie
```

Five-round Show Hand

Time Limit: 4000/2000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 1 Accepted Submission(s): 0

Problem Description

The game of show hand is a card game. There are 52 cards and each card has a number and a suit. There are 13 different numbers called 2, 3, 4, 5, 6, 7, 8, 9, T (number 10), J (number 11), Q (number 12), K (number 13) and A (number 1 or 14), and there are 4 different suits called diamond (d), club (c), heart (h), and spade (s). A card can be represented as its number and its suit. For example, the card with number 10 and suit diamond is represented as "Td", where "T" is for number 10 and "d" is for suit diamond. A hand is a combination of 5 cards.
There are 9 different kinds of hands, sorted from best to worst, listed below.
"Straight Flush": 5 cards with consecutive numbers and the same suit. For example: Td Jd Qd Kd Ad.
"4 of a Kind": 4 cards with the same number and an arbitrary single card. For example: 2d 2c 2h 2s 3d.
"Full House": 3 cards with the same number and the remaining 2 cards have the same number. For example: 6d 6h 6s 7c 7s.
"Flush": 5 cards with the same suit but not consecutive numbers. For example: 2h 3h Qh Kh Ah.
"Straight": 5 cards with consecutive numbers but not the same suit. For example: As 2s 3s 4d 5d.
"3 of a Kind": 3 cards with the same number and the remaining 2 cards have different numbers. For example: Td Tc Ts 9s As.
"2 Pairs": 2 pairs of cards with the same number and the remaining card has a different number. For example: 3h 3s 6c 6h 4h.
"1 Pair": 2 cards with the same number and the remaining 3 cards have different numbers. For example: 4d 4c 2c 5d Ac.
"High Card": 5 cards with different, not consecutive numbers and not the same suits. For example: 2c 3d 8c 9h Ah.
There are 2 players in the game of five-round show hand. When the game starts, each player will get 25 cards from the dealer. Then, for each round, each player shows a hand by choosing 5 cards from the cards he gets, and two players compare the hands they showed. The player who shows a better kind of hand wins the game. If they show the same kind of hands, they discard the cards they have shown and proceed to the next round. There are at most 5 rounds in a game. If they show the same kind of hands in all of the 5 rounds, the game ends in a tie.
Both players play optimally. Your task is to find out the winner and the kind of hands he shows.

Input

The first line is the number of test cases up to 600.
For each test case, there are two lines. The first line is the 25 cards player 1 gets, and the second line is the 25 cards player 2 gets. It is guaranteed that all the 50 cards are different.

Output

For each test case, output a line containing the winner and the kind of hands he shows. If the game ends in a tie,output "Tie" and the kind of hands both player show.

Sample Input

```
3
2d 2h 3d 3c 4d 4s 5d 6h 7d 7c 8d 8c 9d 9s
Td Tc Ts Th Jh Js Qd Qh Kc As Ad
2c 2s 3h 3s 4c 4h 5c 5h 5s 6d 6c 6s 7h 7s
8s 8h 9c 9h Jd Jc Qc Qs Kd Ac Ah
2s 3d 3c 3s 3h 4s 4h 5c 5s 6s 6h 7s 7h 8c
8s Td Th Js Jh Qs Qh Kc Kh Ad As
2d 2h 4d 4c 5d 5h 6d 6c 7d 7c 8d 8h 9d 9c
9s 9h Tc Ts Jd Jc Qd Kd Ks Ac Ah
2d 3d 4d 6d 7d 8d 9d Jd Qd Kd Ad 2c 3c 4c
6c 7c 8c 9c Jc Qc Kc Ac 5h 5s Th
2h 3h 4h 6h 7h 8h 9h Jh Qh Kh Ah 2s 3s 4s
6s 7s 8s 9s Js Qs Ks As 5d Td Tc
```

Sample Output

```
Player 1, Straight Flush
Player 2, Straight Flush, 4 of a Kind,
Flush, Straight, 1 Pair
Tie, Flush, Flush, Flush, Flush, 2 Pairs
```

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Heron and His Triangle

Time Limit: 2000/1000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 349 Accepted Submission(s): 64

Problem Description

A triangle is a Heron's triangle if it satisfies that the side lengths of it are consecutive integers t−1, t, t+ 1 and thatits area is an integer. Now, for given n you need to find a Heron's triangle associated with the smallest t bigger
than or equal to n.

Input

The input contains multiple test cases. The first line of a multiple input is an integer T (1 ≤ T ≤ 30000) followedby T lines. Each line contains an integer N (1 ≤ N ≤ 10^30).

Output

For each test case, output the smallest t in a line. If the Heron's triangle required does not exist, output -1.

Sample Input

```
4
1
2
3
4
```

Sample Output

```
4
4
4
4
```

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Infinite Fraction Path

Time Limit: 6000/3000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 86 Accepted Submission(s): 8

Problem Description

The ant Welly now dedicates himself to urban infrastructure. He came to the kingdom of numbers and solicited an audience with the king. He recounted how he had built a happy path in the kingdom of happiness. The king affirmed Welly's talent and hoped that this talent can help him find the best infinite fraction path before the anniversary.
The kingdom has N cities numbered from 0 to N - 1 and you are given an array D[0 ... N - 1] of decimal digits (0 ≤ D[i] ≤ 9, D[i] is an integer). The destination of the only one-way road start from the i-th city is the city labelled $(i^2 + 1)$%N.
A path beginning from the i-th city would pass through the cities u_1, u_2, u_3, and so on consecutively. The path constructs a real number A[i], called the relevant fraction such that the integer part of it is equal to zero and its fractional part is an infinite decimal fraction with digits D[i], D[u_1], D[u_2], and so on.
The best infinite fraction path is the one with the largest relevant fraction

Input

The input contains multiple test cases and the first line provides an integer up to 100 indicating to the total numberof test cases.
For each test case, the first line contains the integer N (1 ≤ N ≤ 150000). The second line contains an array ofdigits D, given without spaces.
The summation of N is smaller than 2000000.

Output

For each test case, you should output the label of the case first. Then you are to output exactly N characters which are the first N digits of the fractional part of the largest relevant fraction.

Sample Input

```
4
3
149
5
12345
7
3214567
9
261025520
```

Sample Output

```
Case #1: 999
Case #2: 53123
Case #3: 7166666
Case #4: 615015015
```

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Legends of the Three Kingdoms

Time Limit: 8000/4000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 12 Accepted Submission(s): 3

Problem Description

In the game of Three Kingdoms' Legends, there are 4 players called the Monarch, the Minister, the Rebel and theTraitor. They have $h_1, h_2, h_3, and h_4$ health points at the beginning. The players with positive health points aresurviving; the players with zero health points are dead.
The players take turns to move in each round of the game: the Monarch moves first, then the Rebel, the Minister,and finally the Traitor. In a player's turn, if he/she is surviving, he/she must attack a player and the health points of that player will decrease by 1. Note that the dead players cannot attack the other players, and self attacking isnot allowed.
When one of the following events happens, the game ends immediately.
● Both of the Rebel and the Traitor are dead: The Monarch and the Minister win the game, no matter theminister is surviving or not.
● The Monarch is dead: If the Traitor is surviving and all the other players are dead, the Traitor wins; otherwisethe Rebel wins, no matter he/she is surviving or not.
The players have the following common knowledge on their strategies.
● The Monarch and the Minister never attack with each other.
● After attacking the chosen player, the probability of winning the game is maximized.
● If there are multiple players to choose, such that the winning probability is the same and maximized, all theseplayers will be chosen by equal chance.
Your task is to calculate the winning probability of each player.

Input

The first line is the number of test cases up to 10000. For each test case, there is a line containing 4 integers $h_1, h_2, h_3 and h_4$ ($0 < h_1 < 40$, $0 \le h_2 < 40$, $0 \le h_3 < 40$, $0 \le h_4 < 40$).

Output

For each test case, output a line of 3 winning probabilities with the precision of 6 digits, in which the first one is the Monarch and the Minister's winning probability, the second one is the Rebel's and the last one is the Traitor's.

Sample Input

```
4
1 1 1 1
1 0 1 1
1 1 1 2
2 1 2 6
```

Sample Output

```
1.000000 0.000000 0.000000
0.000000 0.500000 0.500000
0.500000 0.500000 0.000000
0.250000 0.500000 0.250000
```

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Little Boxes

Time Limit: 2000/1000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 626 Accepted Submission(s): 179

Problem Description

Little boxes on the hillside.
Little boxes made of ticky-tacky.
Little boxes.
Little boxes.
Little boxes all the same.
There are a green boxes, and b pink boxes.
And c blue boxes and d yellow boxes.
And they are all made out of ticky-tacky.
And they all look just the same.

Input

The input has several test cases. The first line contains the integer t ($1 \le t \le 10$) which is the total number of test cases.
For each test case, a line contains four non-negative integers a, b, c and d where a, b, c, $d \le 2$^62, indicating the numbers of green boxes, pink boxes, blue boxes and yellow boxes.

Output

For each test case, output a line with the total number of boxes.

Sample Input

```
4
1 2 3 4
0 0 0 0
1 0 0 0
111 222 333 404
```

Sample Output

```
10
0
1
1070
```

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New Self-describing Sequence

Time Limit: 10000/5000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 0 Accepted Submission(s): 0

Problem Description

Let a_1, a_2,... be an integer sequence beginning with $a_1 = 1$. For n ≥ 1, a_n+1 is the sum of an and the sum of digits of a_n. That's why we name the sequence a new Self-describing sequence.
The sequence starts with 1, 2, 4, 8, 16, 23, 28, 38, 49, ... and we also define the prefix sum $s_n = a_1 + a_2 + \ldots + a_n$.
For given positive integer n, find a_n and s_n.

Input

The first line of input consists an integer T (T ≤ 32768), indicating the total number of test cases. Each of the following T lines provides an integer n (n ≤ 10^17).

Output

For each test case output its case label first. Then for given n, output a_n and s_n. Since the prefix sum is large,you only need to output s_n mod 1000000009. However you should output a_n as its exact value.

Sample Input

```
7
6
66
666
6666
66666
123456789
31415926535897932
```

Sample Output

```
Case #1: 23 54
Case #2: 752 20862
Case #3: 10949 3407733
Case #4: 136193 441127485
Case #5: 1698899 717710112
Case #6: 5061289531 990040993
Case #7: 2508156610654066874 660828136
```

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Rabbits

Time Limit: 2000/1000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 339 Accepted Submission(s): 121

Problem Description

Here N (N ≥ 3) rabbits are playing by the river. They are playing on a number line, each occupying a different integer. In a single move, one of the outer rabbits jumps into a space between any other two. At no point may two rabbits occupy the same position.
Help them play as long as possible

Input

The input has several test cases. The first line of input contains an integer t (1 ≤ t ≤ 500) indicating the number of test cases.
For each case the first line contains the integer N (3 ≤ N ≤ 500) described as above. The second line contains n integers $a_1 < a_2 < a_3 < ... < a_N$ which are the initial positions of the rabbits. For each rabbit, its initial position
a_i satisfies $1 \le a_i \le 10000$.

Output

For each case, output the largest number of moves the rabbits can make.

Sample Input

```
5
3
3 4 6
3
2 3 5
3
3 5 9
4
1 2 3 4
4
1 2 4 5
```

Sample Output

```
1
1
3
0
1
```

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Tree

Time Limit: 2000/1000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 103 Accepted Submission(s): 27

Problem Description

Consider a un-rooted tree T which is not the biological significance of tree or plant, but a tree as an undirected graph in graph theory with n nodes, labelled from 1 to n. If you cannot understand the concept of a tree here, please omit this problem.
Now we decide to colour its nodes with k distinct colours, labelled from 1 to k. Then for each colour $i = 1, 2, \cdots, k$, define Ei as the minimum subset of edges connecting all nodes coloured by i. If there is no node of the tree coloured by a specified colour i, Ei will be empty.
Try to decide a colour scheme to maximize the size of $E1 \cap E2 \cdots \cap Ek$, and output its size.

Input

The first line of input contains an integer T ($1 \leq T \leq 1000$), indicating the total number of test cases.
For each case, the first line contains two positive integers n which is the size of the tree and k ($k \leq 500$) which is the number of colours. Each of the following n - 1 lines contains two integers x and y describing an edge between them. We are sure that the given graph is a tree.
The summation of n in input is smaller than or equal to 200000.

Output

For each test case, output the maximum size of $E1 \cap E1 ... \cap Ek$.

Sample Input

```
3
4 2
1 2
2 3
3 4
4 2
1 2
1 3
1 4
6 3
1 2
2 3
3 4
3 5
6 2
```

Sample Output

```
1
0
1
```

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Wandering Robots

Time Limit: 16000/8000 MS (Java/Others) Memory Limit: 262144/262144 K (Java/Others)
Total Submission(s): 19 Accepted Submission(s): 13

Problem Description

In an attempt to colonize Mars, some scientists were tasked with cleaning the planet. A cleaning robot, Marsba,was build with a huge restricted area in the Mars as a massive N × N square grid with K (K ≤ 1000) impassable barriers. This area are numbered from (0, 0) to (N - 1, N - 1) sequentially from left to right, row by row, where N ≤ 10000. The starting point of Marsba is situated on the top left corner lattice (0, 0). Marsba had instructions to program him with equal probability of remaining in the same lattice or travelling to an adjacent one. (Two lattices are said to be adjacent if they share a common edge.) This meant an equal probability being split equally between remaining in the lattice and the number of available routes. Specifically, for the lattice Marsba located in which has d adjacent lattices without impassable barriers, the probability for Marsba of remaining in the lattice or travelling to any adjacent lattice is \frac{1}{d+1} .
Then, those scientists completely forgot about it.
Many millennia ago, a young man realizes the importance of the cleaning robot, Marsba, at the end of the forgotten.
For further research, he asks you to calculate the probability of Marsba's location (x, y) satisfying x + y ≥ N - 1.
Let the probability be an irreducible fraction of the form p/q, you should output p and q respectively, with a fraction slash as the separator.

Input

The first line of the input contains an integer t (t ≤ 1000) specifying the number of test cases.
For each case, the first line contains two positive integers N and K. Each of the next K lines contains the coordinate of a barrier.
Note that the starting point (0, 0) has no barrier and all test cases guarantee the connectivity of all lattices free of barriers.

Output

For each case output its label first, then output the probability as an irreducible fraction.

Sample Input

```
5
3 0
3 1
1 1
3 2
1 1
2 2
3 3
1 1
1 2
2 2
5 4
1 1
1 2
2 3
3 2
```

Sample Output

```
Case #1: 2/3
Case #2: 5/8
Case #3: 10/19
Case #4: 7/16
Case #5: 43/71
```