The 25th Annual

ACM International Collegiate Programming Contest ASIA Regional - Taejon

Practice Problem A

Compute a Partial Sum

Input: sum.in

Given two integers *A* and *B*, write a program which computes the sum of integers between A and B.

Input

The first lie of the input file contains an integer T which represents the number of test cases. In the following *T* lines, *T* test cases are given one per line. Each test case consists of two integers *A* and *B*.

Output

Your program should print *t* integers, one per line. The *i*-th integer is the answer that your program has computed for the *i*-th test case.

Sample Input	Output for the Sample Input
2 **4 5** **5 2**	**9** **14**

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Practice Problem B

Cross a Creek

Input: creek.in

There is a creek of *n* meters wide. Crossing the creek, *n*+1 rocks are placed in a straight line (rocks are placed at either sides of the creek). Every two neighboring rocks are 1 meter apart. Chulsoo who is at one side of the creek wants to cross the creek by hopping over the rocks. Chulsoo may jump either to the neighboring rock or to the next to the neighboring rock. That is, Chulsoo may jump either 1 meter or 2 meters in distance. Write a program which computes the number of different jump sequences through which Chulsoo may cross the creek.

If a creek is 4 meters wide, Chulsoo may cross the creek through 5 different jump sequences:
(1) 1 meter + 1 meter +1 meter +1 meter
(2) 1 meter +1 meter +2 meters
(3) 1 meter +2 meters +1 meter
(4) 2 meters +1 meter +1 meter
(5) 2 meters +2 meters

Input

The first line of the input file contains one integer *t* representing the number of test cases. For each test case, a single positive integer *n* is given per line. The integer *n* represents the width of a creek and is less than 100.

Output

Your program should print *t* integers one per line. The *i*-th integer is the answer (the number of different jump sequences) that your program has computed for the *i*-th test case.

Sample Input	Output for the Sample Input
2 **4** **5**	**5** **8**

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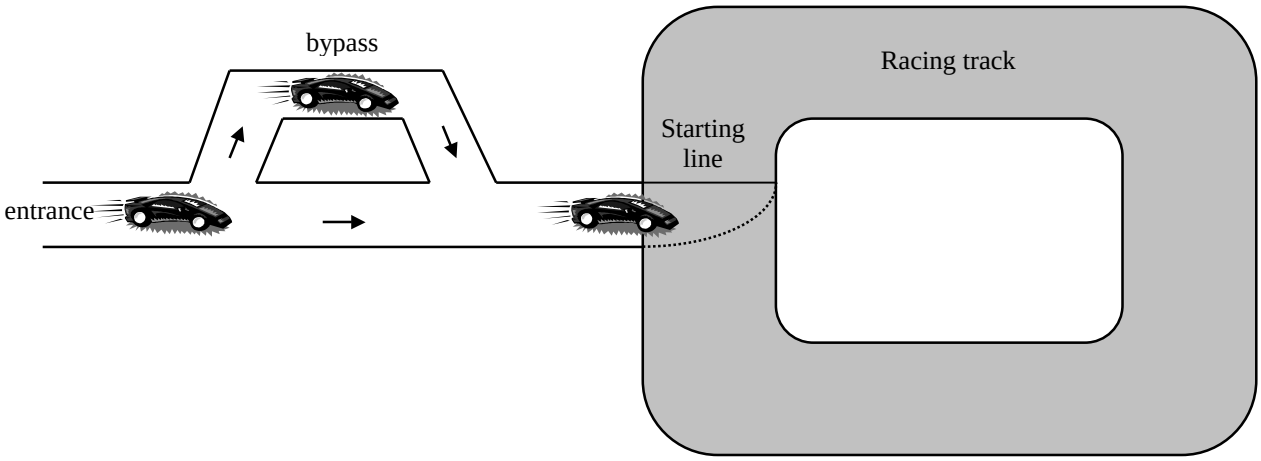
Problem A

Car Racing

Input: car.in

A car racing will be held in the track illustrated below.



As shown above, there is only one lane leading to the starting line. So the racing cars should be line up at the starting line in the order of their numbers which have been assigned according to the records in the preliminary race. When the cars arrive at the main entrance in a certain order, we want to find out whether we can rearrange the cars in the increasing order of their numbers by using a one -lane bypass. Note that the cars should move only forward as designated by the arrows shown in the figure. Also, note that the cars in the bypass should be in a line because the bypass has only one lane. You can assume that the bypass is long enough to accommodate all the cars which participate in the race.

For instance, suppose there are four competitors and they arrive in the order 1, 3, 2, 4. Then we can rearrange the cars so that they can line up in the order 1, 2, 3, 4 at t he starting line as follows: let the car numbered '1' first reach the starting line and the car numbered '3' enter the bypass and wait for the car numbered 2. After the car numbered '2' reaches the starting line, the car numbered '3' comes out from the bypass and arrives the starting line. Finally the car numbered 4 reaches the starting line.

Input

The input consists of several test cases. The first line of the input file contains an integer representing the number of test cases. Each test case begins with a line containing an integer N , indicating the number of cars which participate in the race. The following line represents a permutation of N cars, numbered 1,2,…,N. The consecutive car numbers are separated by a single space. Assume that N is less than 100.

Output

Print exactly one line for each test case in the output. The line should contain "YES" if the test case can be rearranged, and contain "NO" otherwise.

Sample Input	Output for the Sample Input
2 4 1 3 2 4 3 3 2 1	YES NO

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Problem B

Work at a library is tough

Input: library.in

Chulsoo is working part-time at KAIST Central Library. His job is to collect books that have been left on desks by careless users and to relocate them into their original positions on bookshelves. To do this job efficiently Chulsoo collects the books and puts them on a long bookshelf, which is left empty for him, and then sort these books according to their call numbers. He carries the sorted books on a cart, and walks around bookshelves to restore them into proper places.

One of the most difficult tasks for Chulsoo is to sort a number of books on his bookshelf according to their call numbers. He usually selects two books that are "out of order" and swaps them, and selects another two books that are "out of order" and swaps them, and repeats this "select-and-swap" process until all books are sorted. We say that two books are "out of order" if one with smaller call number is to the right of another with larger call number.

You are to write a program to sort the books using a minimum number of swaps in ascending order of their call numbers.

Input

The first line of the input file contains one integer *t* representing the number of test cases. Each case is described by two lines: the first line contains one integer *n*, which is the number of books on Chulsoo's bookshelf, and the second line contains a sequence of *n* positive integers, in which the *i*-th integer is the call number of the book at position *i*. Assume that the call numbers of the books are all different and each of them does not exceed 10,000. Also, assume that *n* does not exceed 1,000.

Output

Your program should print a sequence of *t* integers. The *i*-th integer is the number of swaps for the *i*-th test case that your program has computed.

Sample Input	Output for the Sample Input
2 5 25 347 12 19 203 7 55 101 47 61 82 11 96	3 4

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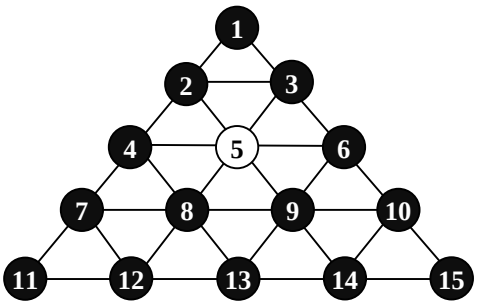
Problem C

Moving Pegs

Input: peg.in

Venture MFG Company, Inc. has made a game board. This game board has 15 holes and these holes are filled with pegs except one hole. A peg can jump over one or more consecutive pegs to the nearest empty hole along the straight line. As a peg jump over the pegs you remove them from the board. In the following figure, the peg at the hole number 12 or the peg at the hole number 14 can jump to the empty hole number 5. If the peg at the hole number 12 is moved then the peg at the hole number 8 is removed. Instead, if the peg at the hole number 14 is moved then the peg at the hole number 9 is removed.



Write a program which find a shortest sequence of moving pegs to leave the last peg in the hole that was initially empty. If such a sequence does not exist the program should write a message "IMPOSSIBLE".

Input

The input consists of *T* test cases. The number of test cases (*T*) is given in the first line of the input file. Each test case is a single integer which means an empty hole number.

Output

For each test case, the first line of the output file contains an integer which is the number of jumps in a shortest sequence of moving pegs. In the second line of the output file, print a sequence of peg movements. A peg movement consists of a pair of integers separated by a space. The first integer of the pair denotes the hole number of the peg that is moving, and the second integer denotes a destination (empty) hole number.

Sample Input	Output for the Sample Input
1 5	10 12 5 3 8 15 12 6 13 7 9 1 7 10 8 7 9 11 14 14 5

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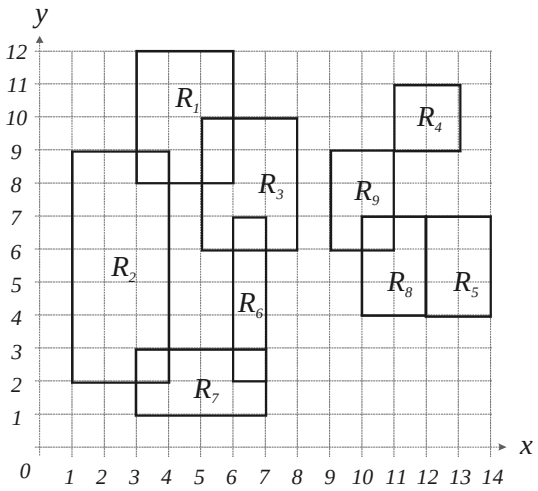
Problem D

Rectangle Coloring

Input: rect.in

You are given n axis-parallel rectangles on a plane. Here, an axis -parallel rectangle is a rectangle whose edges are parallel to either x-axis or y-axis. You are to find the number of colors to paint the given n rectangles according to the following rules:

1. Each rectangle has to be painted with one color.
2. A pair of intersecting rectangles must have the same color. Two rectangles are intersecting if their intersection is not empty when we regard a rectangle as a set of points including the boundary.
3. A rectangle R_a must have the same color as R_b if there is a sequence of rectangles $R_a = R_{i_1}, R_{i_2}, \ldots, R_{i_k} = R_b$ such that R_{i_j} and $R_{i_{j+1}}$ are intersecting for all $1 \le j < k$; otherwise, they must have different colors. For instance, rectangle R_9 in the following figure must have the same color as R_4, R_5, R_8, and have a different color from R_1, R_2, R_3, R_6, R_7.



Input

The input consists of T test cases. The number of test cases (T) is given in the first line of the input file. Each test case begins with a line containing an integer N, $1 \le N \le 200$, that represents the number of rectangles in the test case. Each of the following N lines contains four positive integers x_1, y_1, x_2, and y_2, $1 \le x_1, y_1, x_2, y_2 \le 10000$, representing a rectangle. (x_1, y_1) and (x_2, y_2) are the (x, y)-coordinates of the lower-left and upper-right corners of the rectangle, respectively. The four integers are delimited by one or more spaces. From the $N+3$-th line, the remaining test cases are listed in the same manner as above.

Output

The output should contain the number of colors, one per line.

Sample Input	Output for the Sample Input
2 9 3 8 6 12 1 2 4 9 5 6 8 10 11 9 13 11 12 4 14 7 6 2 7 7 3 1 7 3 10 4 12 7 9 6 11 9 4 11 9 13 11 12 4 14 7 10 4 12 7 9 6 11 9	2 1

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Problem E

Match Maker

Input: match.in

You are a manager of a match maker company ACM(Amazing Coupling Marriage) whose main role is to make happy matches between men and women.

N men and N women who are registered to the company want to marry as soon as possible. Each man and each woman have a list of preferences for all the people of the opposite sex. The most preferable person will come at the first position in the list, the second preferable person will come at the next, and so on. The table below shows a set of preference lists that might exist among 4 men and 4 women.

M_1	$W_2\ W_4\ W_1\ W_3$		W_1	$M_4\ M_1\ M_2\ M_3$
M_2	$W_1\ W_2\ W_3\ W_4$		W_2	$M_4\ M_3\ M_2\ M_1$
M_3	$W_2\ W_3\ W_4\ W_1$		W_3	$M_1\ M_4\ M_2\ M_3$
M_4	$W_1\ W_3\ W_2\ W_4$		W_4	$M_3\ M_2\ M_1\ M_4$

Your task is to make matches of all the men to all the women in such a way as to respect all their preferences as much as possible. However, you must assume that anyone assigned to someone other than their first choice will be disappointed and will always prefer anyone higher up on the list. If the N matches are chosen such that there exist a man and a woman who are not married on each other, but who would both prefer each other to their actual marriage partners, then the matches are said to be *unstable*. If no such pair exists, it is called *stable*. For example, a match "$M_1W_3\ M_2W_1\ M_3W_4\ M_4W_2$" is unstable because M_1 prefers W_1 to W_3, and W_1 prefers M_1 to M_2. The unstable couples might be separated easily after marriage; this is a definitely bad situation that you want to avoid.

In general, there are many different stable matches for a given set of preference lists. Your task is to print just one stable match among them.

Input

The input consists of T test cases. The number of test cases (T) is given in the first line of the input file. Each test case begins with a line containing an integer N less than 100, indicating that N men and N women are given. The following N lines represent the men's preferences for the women, where the i-th line contains the preference list of a man with id i in order of preferences of the N women; he prefers a woman X to another woman Y if X precedes Y in the list. The following N lines represent the women's preferences for the N men. Assume that all men and all women have consecutive id-numbers from 1 to N.

Output

Print exactly one line for each test case. The line should contain a stable match for the test case. Each match should be represented as a sequence of the women's id, according to the increasing order of men's id. The

woman with the first id in the match is a partner of the man with id '1', the woman with the second id in the match is a partner of the man with id '2', and the woman with the i-th id in the match is a partner of the man with id 'i'. The consecutive women's id in the match should be separated by a single space.

Sample Input	Output for the Sample Input
2 6 6 1 4 5 2 3 2 3 5 4 1 6 2 1 5 3 6 4 4 5 6 2 3 1 6 3 4 5 2 1 6 4 1 3 5 2 5 6 4 2 3 1 4 6 1 5 3 2 5 4 3 1 6 2 4 3 1 6 2 5 5 3 4 6 2 1 3 2 6 4 5 1 3 1 2 3 3 2 1 2 1 3 1 2 3 3 2 1 2 1 3	2 5 1 4 3 6 1 3 2

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Problem F

Taekwondo

Input: taekwon.in

Taekwondo is the name of a traditional Korean martial art and it is turned into a modern international sport. It is adopted by IOC (International Olympic Committee) as an official game of 2000 Sydney Olympic Games. In Taekwondo, there are individual competitions and team competitions. An individual competition is conducted by two players and a team competition is a set of individual competitions. For two groups of players, we are going to make a team competition where two players for each individual competition are selected from each group. Note that players in each group can participate at most one individual competition. For fair competition, weights of two players in each individual competition must be very close . Given weights of players in two groups, you are to write a program to find pairs of players so that the sum of the absolute differences of the weights of two players in each competition is minimized.

Input

The input file consists of several test cases. The first line of the input file contains an integer representing the number of test cases. The first line of each test case contains two integers. The first integer, n_1, is the number of players in the first group, and the second int eger, n_2, is the number of p layers in the second group, where $1 \le n_1, n_2 \le 500$. You have to make $\min\{n_1, n_2\}$ pairs of players . Each line of the next n_1 lines contain s the weight of the player in the first group and the next n_2 lines contain the weights of players in the second group. Weights of players are in the range of 40.0 to 130.0. You may assume that the precision of weight is one tenth.

Output

For each test case, your program reports the minimum of the sum of the absolute differences of the weights of two players in each individual competition in the team competition.

The following sample input and corresponding correct output represents two test cases.

Sample Input	Output for the Sample Input
2 2 3 44.9 50.0 77.2 86.4 59.8 4 2 44.9 50.0 77.2 86.4 59.8 58.9	42.1 23.8

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Problem G

Lost Lists

Input : list.in

Younghee an elementary school student just finished her homework. Today her teacher gave her several lists each containing distinct positive integers. The homework was to calculate every sum of each pair of integers in a list. The teacher gave students mutually different lists for preventing copying out. So, she had to do the homework all by herself. It was hard job because she is not so good at arithmetic and pretty many lists were given. After finishing her homework Younghee went out to play with her friends. When Younghee returned to home she found out the lists were lost. Only the papers she wrote the sums were there. Younghee should return the lists at the next class because her teacher would check up her homework with the lists. Finally Younghee found out who did it. Her mother thought the lists as garbage and threw them into the garbage can and emptied it. Soon after listening to her mother, Younghee ran to the garbage box in the outside. Alas! The garbage collector already emptied the box. After a little consideration Younghee thinks there might be a way to restore the lists. She calls you and asks you to help her.

In this problem, you are to solve Younghee 's trouble. For each list of sums Younghee wrote, your program should restore the list of distinct integers. But, Younghee is not so good at arithmetic. So, there can be a list of sums which is not restorable, that is, there does not exist a list of integers which leads to the sums. In that case your program should print -1.

Input

The input contains T test cases. The first line of input contains a single integer (T) representing the number of test cases which is exactly the number of lists Younghee received from her teacher. Each test case begins with a line containing an integer n, $2<n<50$, indicating the number of integers in a list. In the next line, there are $n(n-1)/2$ positive integers which are the sums of all possible pairs in non-decreasing order. Each number in the sums will be less than 10000.

Output

Print exactly one line for each test case. The output should consist of n distinct positive integers in increasing order, if restorable. If not restorable, -1 should be printed. Numbers should be separated by a single space.

Sample Input	Output for the Sample Input
3 4 4 5 7 10 12 13 3 2 5 6 5 3 4 5 5 6 6 7 7 8 9	1 3 4 9 -1 1 2 3 4 5

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Problem H

Coins

Input: coins.in

Once upon a time the following puzzle was suggested to pupils on a regional middle school olympiad on mathematics:

* A set of coins consists of 15 coins: 14 co ins are valid while a remaining 15-th coin is a false one. All valid coins have one and the same weight while the false coin has a different weight. One valid coin is marked. Is it possible to identify a false coin balancing coins 3 times at most?

A jury member was a trainer of a team of undergraduates for programming contests. So a question on how to put the puzzle for programming arose naturally. Finally the problem was formulated as follows:

* A set of coins consists of *N* coins: (*N*-1) coins are valid while a remaining *N*-th coin is a false one. All valid coins have one and the same weight while the false coin has a different weight. One valid coin is marked. Write a program which for every input pair

- a number *N* of coins under question,
- a limit *K* of balancing

outputs either "POSSIBLE" or "IMPOSSIBLE" with respect to existence of a strategy to identify the false coin balancing coins K times at most.

Input

The first line of input contains a single integer *T* that represents a total amount of different pairs (*N, K*) to process. Every line of next *T* lines contains two integers *N*, $2 \le N \le 100$ and *K*, $0 \le K \le 100$.

Output

The output file should contain *T* lines with "POSSIBLE" or "IMPOSSIBLE" per line.

Sample Input	Output for the Sample Input
3 6 2 10 2 15 3	POSSIBLE IMPOSSIBLE POSSIBLE