Week 01: Warming Up

Problem 01: Chocolates

We are given a sequence of N positive integers where each value represents number of chocolates in a packet. Each packet can have variable number of chocolates. There are M students. The task is to distribute chocolate packets such that :

(1) Each student gets exactly one packet.

(2) The difference between the number of chocolates in packet with maximum chocolates and packet with minimum chocolates given to the students is minimum.

For an example, let's say that the sizes of chocolate packages are {7, 3, 2, 4, 9, 12, 56} and the number of student M is 3. If we pick 2, 3 and 4, we get the minimum difference 2 between maximum and minimum packet sizes. N and M are at most 1,000,000 and M ≦ N. Your program should terminate in 2 second.

Input

Your program is to read from the input file named "input01.txt". The input consists of T≤20 test cases. The number of test cases T is given in the first line of the input file. Each test case consists of two lines. The first line contains two integers N and M. The next line contains N integers which are the sizes of N chocolate packages.

Output

Your program is to write the answer to the standard output. Print the minimum difference in one line for each test case.

Sample Input	Output for the Sample Input
3 7 3 7 3 2 4 9 12 56 8 5 3 4 1 9 56 7 9 12 17 7 12 4 7 9 2 23 25 41 30 40 28 42 30 44 48 43 50	2 6 10

Problem 02: Platforms

Given arrival and departure times of all trains that reach a railway station, find the minimum number of platforms required to accommodate all the trains. Suppose that we have 6 trains and their arrival and departure times are as follows:

(9:00, 9:10), (9:40, 12:00), (9:50, 11:20), (11:00, 11:30), (15:00, 19:00), (18:00,20:00)

The first train arrives at 9:00 and departs at 9:10, the second train arrives at 9:40 and departs at 12:00, and so on. Two trains can share a platform if their time intervals do not overlap. In the example, the first and the second train can share a platform since their time intervals do not overlap, while the second and the third train cannot share a platform since their time intervals overlap. When the departure time of a train is exactly equal to the arrival time of another train, two trains can share a platform. In the above example, the station should have at least three platforms since three trains (2nd, 3rd, and 4th train) stay at the station between 11:00 and 11:20.

Given arrival and departure times of N trains, write a program to compute the minimum number of required platforms. Each arrival and departure time is between 00:00 and 24:00. The number of trains N is at most 100,000. Your program should terminate in 2 seconds.

Input

Your program is to read from the input file named "input02.txt". The input consists of T≤20 test cases. The number of test cases T is given in the first line of the input file. The first line of each test case contains an integer N which is the number of trains in the test case. The subsequent N lines contain the arrival and departure times of the trains one at a line. Each arrival and departure time is represented as an integer between 0 and 2400. For examples, 0 means 00:00, 5 means 00:05, 30 means 00:30, 123 means 1:23, and 2200 means 22:00.

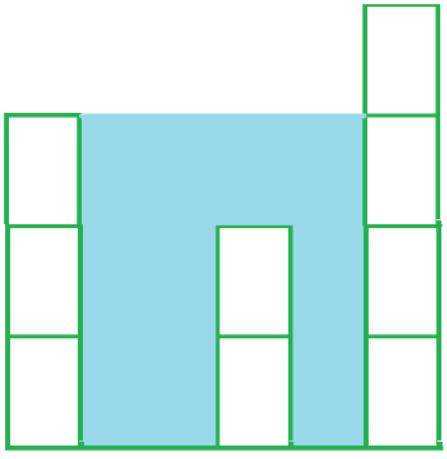
Output

Your program is to write the answer to the standard output. Print the minimum number of platforms in one line for each test case.

Sample Input	Output for the Sample Input
2 3 0 100 200 300 250 300 6 900 910 940 1200 950 1120 1100 1130 1500 1900 1800 2000	2 3

Problem 03: Water

Given N≦1,000,000 non-negative integers representing an elevation map where the width of each bar is 1, compute how much water it is able to trap after raining. The following figure depicts the situation where given integers are {3, 0, 0, 2, 0, 4}. The total amount of trapped water is 10 as illustrated in the figure.



Bars for input {3, 0, 0, 2, 0, 4}
Total trapped water = 3 + 3 + 1 + 3 = 10

For an another example, if given integers are {0, 1, 0, 2, 1, 0, 1, 3, 2, 1, 2, 1}, then the amount of trapped water is 6, 1 unit of water between 1 and 2, 4 units of water between first 2 and 3, and 1 unit of water between second last 1 and last 2.

Input

Your program is to read from the input file named "input03.txt". The input consists of T≤20 test cases. The number of test cases T is given in the first line of the input file. The first line of each test case contains an integer N and the next line contains N non-negative integers.

Output

Your program is to write the answer to the standard output. Print the answer in one line for each test case.

Sample Input	Output for the Sample Input
3 6 3 0 0 2 0 4 12 0 1 0 2 1 0 1 3 2 1 2 1 5 0 1 2 3 4	10 6 0