**Problem A:**

**Fibonacci**

Time Limit: 1 second

**Problem Description**

Fibonacci is well known. This is a similar task. Let f(3)=f(2)=f(1)=1, and F(i)=a\*f(i-1)+b\*f(i-2)+c\*f(i-3) for all i>3, where a, b, and c are given constants. Given a positive integer n and a prime p, find f(n) (mod p).

**Technical Specification**

* + The number of test cases is at most 10.
  + a, b, and c are positive integers less than 10.
  + n and p are positive 31-bit integers.

**Input Format**

The test file contains several test cases. Each line is a test case and contains 5 integers n, p, a, b, and c, separated by a space.

**Output Format**

For each test case, output the result in one line.

**Example**

|  |  |
| --- | --- |
| **Sample Input:** | **Sample Output:** |
| 6 7 1 2 3 | 5 |

**Problem B:**

**Power and exponential functions**

Time Limit: 1 second

**Problem Description**

Given positive integers x, n and a prime P, you are asked to compute the n-th power of x modulo P, that is, xn (mod P).

**Technical Specification**

* + The number of test cases is at most 10.
  + The numbers of digits of n and x are at most 200.
  + P is a positive 31-bit integer.

**Input Format**

The test file contains several test cases. Each line is a test case and contains three integers x, n and P in this order, separated by a space.

**Output Format**

For each test case, output the result in one line.

**Example**

|  |  |
| --- | --- |
| **Sample Input:** | **Sample Output:** |
| 10 2 7  20 1 23 | 2  20 |

**Problem C:**

**Maximum Difference Within a Range**

Time Limit: 2 seconds

**Problem Description**

You are given an integer sequence and a range bound . Your job is to find the maximum difference for numbers in such that the difference of indices of these two numbers is within the bound . That is, find for and .

**Input File Format**

The input will consist of several input cases. The first line of each test case contains two numbers and , as described above, and they are separated by a space. You can assume that and . The next line consists of space-separated integers ’s that represent the sequence where . An input case with indicates the end of the input.

**Output File Format**

You have to print the required maximum diﬀerence for each case in the input. Format the output as shown below.

**Example**

|  |  |
| --- | --- |
| **Sample Input** | **Sample Output** |
| 6 2  1 8 -1 10 7 4  5 3  -4 1 5 2 6  5 5  1 2 3 4 5  10 11  1 1 1 1 1 1 1 1 1 1  20 4  1 2 3 4 5 6 7 8 9 0 9 8 7 6 5 4 3 2 1 0  0 0 | 11  9  4  0  9 |

**Problem D:**

**Minimum risk shortest path**

Time Limit: 3 seconds

**Problem Description**

You are given a directed network with a positive weight on each edge. The weight is the risk of the edge. And the risk of a path is defined by the maximum risk of edges it passes. In the mean time, there is also a length for each edge. Given two nodes s and t in such a network, you need to find a path of minimum risk from s to t. Furthermore, if there are more than one such path, you need to find the path of shortest length amongst all paths of the minimum risk.

**Input File Format**  
The first line has an integer which indicates the number of test cases. The first line of each test case has two integer n and m, 1<n<=30000 and 1<=m<=500000, in which n is the number of nodes and m is the number of edges in this case. In the next m lines, each contains four integers i, j, r and w, by which it means that there is an edge from i to j of risk r and length w. For each case, s is node 0 and t is node n-1. And the risk is a positive integer at most 10000. The edge lengths are nonnegative and the final solution is a 31-bit integer.

**Output Format**For each case, output the minimum risk and the minimum length of any minimum risk path in one line. If there is no such path, print -1.

**Example**

|  |  |
| --- | --- |
| **Sample Input:** | **Sample Output:** |
| 1  4 5 0 1 5 1  0 2 18 10  0 3 20 5  1 3 20 5  2 3 18 20 | 18 30 |

**Problem E:**

**Medians**

Time Limit: 1 second

**Problem Description**

Median plays an important role in the world of statistics. By definition, it is a value which divides an array into two equal parts. In this problem you are to determine the current median of some long integers. Suppose, we have five numbers {1,3,6,2,7}. In this case, 3 is the median as it has exactly two numbers on its each side: {1,2}and {6,7}. If there are even number of values like {1,3,6,2,7,8}, only one value cannot split this array into equal two parts, so we consider the average of the middle values {3,6}. Thus, the median will be (3+6)/2 = 4.5. In this problem, you have to print only the integer part, not the fractional. As a result, according to this problem, the median will be 4 !

**Input File Format**

The input file consists of series of integers *X* (0<= *X <* 231) and total number of integers *N* is less than 10000. The numbers may have leading or trailing spaces.

**Output Format**

Print the total sum of all the medians (modulo 109+7).

(計算前i個數字的medians, for i=1,2,…,N, 輸出總和除以109+7的餘數。)

**Example**

|  |  |
| --- | --- |
| **Sample Input** | **Sample Output** |
| 1  3  4  60  70  50  2 | 44 |

**Problem F:**

**Linear functions**

Time Limit: 1 second

**Problem Description**

There are n linear functions f\_i(x)=a[i]x+b[i], 1<= i <=n. Define F(x)=max{f\_i(x) : 1<= i <=n}. Given m x-values c[1],c[2],…, c[m], please compute the sum of all F(c[j]), i.e., F(c[1])+ F(c[2])+…+ F(c[m]).

**Technical Specification**

* + The number of test cases is at most 5.
  + n<45 000 and m<=10 000.
  + a[i], b[i], and c[i] are 32-bits integer. The result is a 64-bits integer.

**Input Format**

The test file contains several test cases. The first line of a test case contains n and m. The following n lines are a[i] and b[i] for i from 1 to n. The last line contains the m integers c[1],c[2],…,c[m]. The case n=0 indicates the end of the input, and you do not need to proceed it.

**Output Format**

For each test case, output the result in one line.

**Example**

|  |  |
| --- | --- |
| **Sample Input:** | **Sample Output:** |
| 4 5  -1 0  1 0  -2 -3  2 -3  -5 -1 0 2 4  0 0 | 15 |