ETH Zurich
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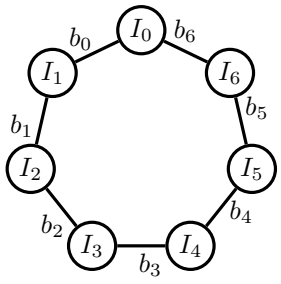
HS 2015
Exercise Sheet 1

ACM Programming Challenges Lab

Exercise 1 – *Server placement on a circle*

In the island nation of Qux consists of an odd number n of islands arranged on a circle. Between any two neighbouring islands I_i and I_{i+1} (addition being mod n), there is an undersea telecommunications cable with a bandwidth of b_i. The following picture shows the situation for $n = 7$.



The national telecommuncations company of Qux wants to choose two islands I_i and I_j as a location for new servers. For logistical reasons, there is some $k < n/2$ such that these two islands must have exactly $k - 1$ islands between them on the circle, i.e., $j \equiv i + k$ (mod n).

The company wants you to choose the locations in such a way that the bandwidth between the two chosen islands is largest, where the bandwidth between two islands I_i and I_j is the maximum of the minimum bandwidths along the two paths from I_i to I_j on the circle.

Since they are not sure which k to pick exactly, your program should be able to evaluate several proposals for k.

Input The first line contains an integer $1 \leq t \leq 10$, the number of testcases following. Each testcase starts with a line containing a positive odd integer n and a positive integer q. This is followed by a line containing n integers $b_0, \ldots, b_{n-1}$ where b_i represents the bandwidth between the islands I_i and and I_{i+1} (mod n). Then there is a third line containing q integers $k_1, \ldots, k_q$ where $1 \leq k_\ell < n/2$.

You can assume that $1 \leq n \leq 50\,000$, $1 \leq q \leq 10$ and $1 \leq b_i \leq 1\,000\,000$ for all i. For 30 points, you can assume that $n \leq 2000$.

Output For each testcase output q lines containing where the ℓ-th line contains two numbers i and j between 0 and $n - 1$ such that (i) $j \equiv i + k_\ell$ (mod n) and (ii) the islands I_i and I_j have minimal bandwidth between them. If there are several possible choices, output the one where i is smallest. Note that since addition is mode n it is possible that $j < i$.

Sample Input

```
2
7 2
1 2 1 3 2 3 3
3 2
5 1
1 2 1 3 1
1
```

Sample Output

```
0 3
5 0
3 4
```

(100 Points)