Lightspeed Salesman

Time limit: 1 sec

You are a salesman. Every day, you have to visit all associated companies and you have to visit them for **N** consecutive days. Your boss tells you to visit each company in a given order every day. You have to strictly obey this order.

However, the city that these companies are located is very strange. The road in this city connects into a circle and each company is located on this circle. So, if you wish to go from company A to company B, you either go clockwise or counter-clockwise along this circular road. There is no other road.

For simplicities, these associated companies are labeled by number 0 to **M**-1 according to their position along the road, i.e., company 0 is to the left of company 1. Company 1 is located to the left of company 2, and so on. Finally, company **M**-1 is located to the left of company 0, forming a circle.

This circular road is not the strangest thing in this city. This city has natural phenomenon. Each day, two portals connecting two points in the road appear. These portals allow a person from point **A** to travel to point **B** in an instant, i.e., there is no distance between point A and B when the portal is open. Strange enough, these portals coincidentally appear at the doorstep of two different companies. At the end of the day (definitely after you visit all companies), these portals disappear. They will reappear again tomorrow, maybe at different companies.

You are trying to take advantage of this portal. You wish to know the minimum travel time you need to visit all companies on each of these days, providing that when you take the portal, no time is counted. The scientist in the city gives you the location that the portal appears for these **N** days that you will stay in the city.

Input

- The first line of each test case contains two integers **N** ($1 \leq N \leq 10,000$) and **M** ($2 \leq M \leq 1,000$) which are the number of days and the number of companies in the city you have to visit every day.
- This is followed by a line containing **M** integers giving the sequence of companies to visit. It is assume that, in the morning, you always start at the first company in the sequence and after you visit the last company in the sequence, you have to go back to the first company in the sequence.
- The next line contains **N** positive integers $t_0 t_1 t_2 t_3 \ldots t_{M-1}$ where t_i gives the time to travel from company i to company $i+1$ and t_{M-1} gives the time to travel from company $M-1$ to company 0.
- The next **N** lines follow. Each line gives two integers **A** and **B** ($0 \leq A < B < N$) indicating the indices of the companies that the portals appear on that particular day.

Output

The output must contains **N** lines, each with the minimum time on the road in order to visit all companies on each day, starting from the first day.

Example

Input	Output
1 4 0 1 2 3 5 3 3 3 0 12 4 0 2 1 3 5 6 7 3 0 1 2 3	9
2 4 0 2 1 3 5 6 7 3 0 1 2 3	18 18