

Problem J

Phosphorus studying Polygon

Time limit: 6s
Memory limit: 1GB

Phosphorus has drawn n regular polygons on a 2D Cartesian plane. The polygons are numbered from 1 to n .

Each regular polygon i is described by its center coordinates (x_i, y_i) , the distance from the center to its vertices r_i (the circumradius), and the number of sides k_i . To avoid ambiguity with rotation, assume that one of the vertices of the i -th polygon is always located at exactly $(x_i, y_i + r_i)$, and the remaining $k_i - 1$ vertices are spaced evenly along the circumcircle.

We say that two polygons intersect if they share at least one common point (this includes points on their boundaries and within their interiors). Note that a polygon always intersects itself.

It is guaranteed that whenever two polygons are disjoint, their minimum Euclidean distance is at least 10^{-3} . Here, the distance between two polygons is the minimum distance between a point in the first polygon and a point in the second polygon. This guarantee does not exclude polygons that touch: touching polygons intersect and have distance zero.

Phosphorus will give you q queries. Each query consists of a single integer u ($1 \leq u \leq n$). For each query, consider all polygons that intersect the u -th polygon. Among these intersecting polygons, you must find the index j ($1 \leq j \leq n$) of the polygon that has the **maximum total area**.

Hint: The area of a regular polygon with k sides and circumradius r can be calculated using the formula $\text{Area} = \frac{1}{2}kr^2 \sin\left(\frac{2\pi}{k}\right)$. It is guaranteed that whenever two polygons have different pairs (k_i, r_i) , the larger of their two areas is at least $(1 + 10^{-12})$ times the smaller one, so evaluating this formula with standard 64-bit floating-point types (e.g., `double` in C++ and Java, or `float` in Python) is precise enough to compare areas.

Input

- The first line contains two integers n and q ($1 \leq n, q \leq 3 \times 10^5$) — the number of polygons and the number of queries.
- Each of the next n lines contains four integers x_i, y_i, r_i , and k_i ($-10^6 \leq x_i, y_i \leq 10^6$, $1 \leq r_i \leq 10^6$, $3 \leq k_i \leq 7$) — the coordinates of the center, the circumradius, and the number of sides of the i -th polygon.
- Each of the next q lines contains a single integer u ($1 \leq u \leq n$) — the index of the polygon for the current query.

Output

Print q lines. For the m -th query, output a single integer j — the index of the polygon with the maximum total area that intersects the polygon u . If there are multiple intersecting polygons that share the same maximum area, output the one with the **minimum index**.

Sample Input	Sample Output
4 4	1
0 0 2 3	3
2 0 2 3	3
6 0 3 3	4
0 5 2 3	
1	
2	
3	
4	

Notes

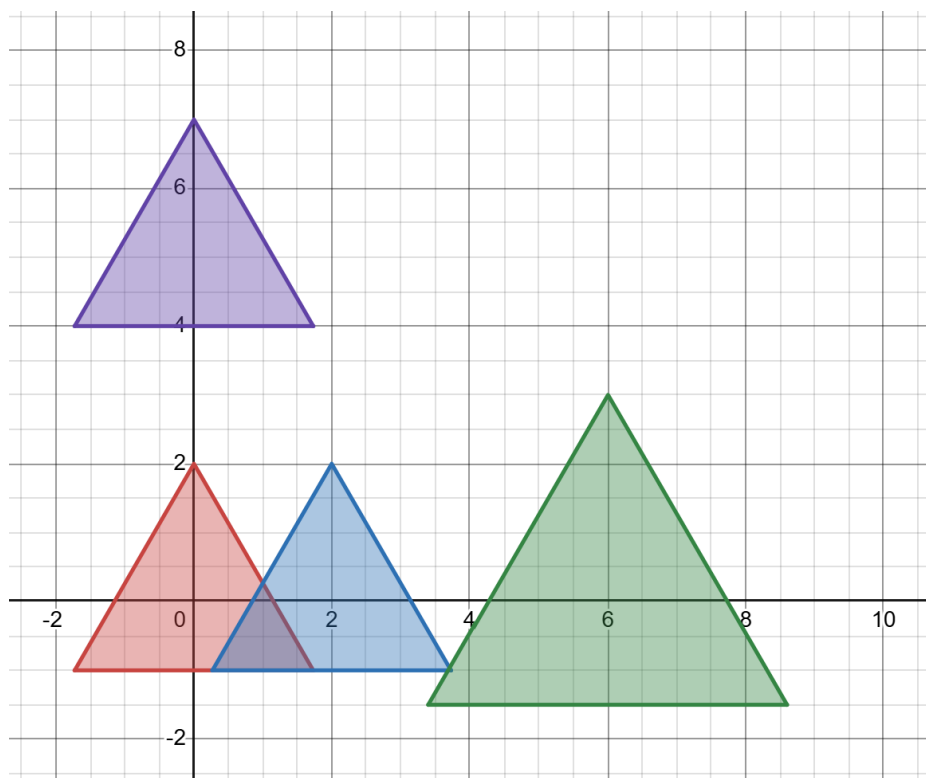


Figure 1: The polygon formation in the example.