

Inside or outside?

Given N points in counterclockwise order, who represent a convex polygon with N edges and N vertex, you must answer Q queries, each of them represents one point. Use cross product to determine if the point is inside or outside the polygon.

Input

The first line contains 2 integers, N and Q , each of them lower than 10^3 .

The second line has $2*N$ integers, with vales between -10^6 and 10^6 , separated by a single space that represent the X_i and Y_i coordinates of the i -th vertex of the polygon in counterclockwise order.

Format: $X_1 Y_1 X_2 Y_2 \dots X_N Y_N$

Next you will receive Q lines. Each line has two integers X and Y separated by space between -10^6 and 10^6 representing a query.

Obs: It is guaranteed that the given polygon has no repeated vertices, but it may have collinear points.

Obs2: If a point lies on an adge of the polygon it must be considered inside the polygon.

Output

For each query (in the given order) print a sinle line that cointains a letter 'D' if the point is inside the polygon or a letter 'F' if it's outside.

Example

Input:

```
3 3
0 0 3 0 0 3
-1 -1
0 0
1 1
```

Output:

```
F
D
```

