Problem E. Roco Kingdom World

tarjen has recently been playing Roco Kingdom and wants to catch some **shiny spirits**.

To farm shiny spirits, *tarjen* must first repeatedly catch **regular spirits**. Catching regular spirits accumulates the pollution progress of a shiny pool. When the pollution progress reaches the required threshold, a **corrupted spirit** belonging to that pool spawns on the map. After defeating a corrupted spirit, there is a chance to encounter a **shiny spirit**.

However, the number of corrupted spirits on the map is limited. If too many spawn, old corrupted spirits are pushed out by new ones.

Additionally, there is a pity mechanism for shiny encounters. Each shiny pool has an independent pity counter. Each time a corrupted spirit from that pool is defeated, the pool's pity counter increases by one. When a pool's pity counter reaches 80, defeating a corrupted spirit from that pool is guaranteed to trigger a shiny encounter.

The detailed rules are as follows.

There are n types of regular spirits, A families, and B elements. The i-th type of regular spirit belongs to family fa_i and has element el_i.

There are two types of shiny pools:

- **Family pool** F_x: the shiny pool for the x-th family.
- **Element pool** E_x: the shiny pool for the x-th element.

Each shiny pool P maintains four values:

- $progress_P$: pollution progress, initially 0.
- $pity_P$: pity counter, initially 0.
- $need_P$: the number of regular catches needed to spawn one corrupted spirit (a given constant).
- $luck_P$: the luck threshold (a given constant).

At most m corrupted spirits can exist on the map simultaneously. All corrupted spirits are arranged in a queue ordered by spawn time (oldest first). If the count exceeds m, the oldest corrupted spirits are removed from the front until the count is at most m. Corrupted spirits pushed out by the map capacity are not considered defeated and do not affect any pool's pity counter.

There are q operations, each being one of the following two types.

Operation 1: Regular Catch

```
C T x c
```

tarjen catches the x-th type of regular spirit c times consecutively, crediting these c catches to a certain shiny pool. If $T = F$, credit to family pool F_{fa_x}; if $T = E$, credit to element pool E_{el_x}.

Let the credited pool be P. Set $progress_P \mathrel{+}= c$. Then, whenever $progress_P \geq need_P$, spawn one corrupted spirit belonging to pool P and set $progress_P \mathrel{-}= need_P$.

Note that a single catch operation may spawn multiple corrupted spirits.

The newly spawned corrupted spirits are appended to the end of the queue in order. If the count exceeds m, the oldest corrupted spirits are removed from the front.

Operation 2: Defeat Corrupted Spirit

```
B k r
```

tarjen challenges the k-th corrupted spirit on the map (ordered from oldest to newest).

If there are fewer than k corrupted spirits on the map, output `MISS` and no state changes occur.

Otherwise, let the corrupted spirit belong to pool P. Remove it from the map and set $pity_P \mathrel{+}= 1$.

Then perform the **shiny check**. Each pool P has a luck threshold $luck_P$. If $r \le luck_P$ or $pity_P = 80$, a shiny is encountered: output `SHINY P` and set $pity_P = 0$. Otherwise, output `NORMAL P` $pity_P$.

Input

The first line contains five integers n, A, B, m, q ($\mathbf{1 \le n, A, B, m, q \le 2 \times 10^5}$) — the number of regular spirit types, the number of families, the number of elements, the maximum number of corrupted spirits on the map, and the number of operations.

The next n lines each contain two integers fa_i, el_i ($1 \le fa_i \le A$, $1 \le el_i \le B$).

The next line contains A integers $need_{F_1}, \ldots, need_{F_A}$ ($1 \le need_{F_i} \le 10^9$).

The next line contains B integers $need_{E_1}, \ldots, need_{E_B}$ ($1 \le need_{E_i} \le 10^9$).

The next line contains A integers $luck_{F_1}, \ldots, luck_{F_A}$ ($0 \le luck_{F_i} \le 10^9$).

The next line contains B integers $luck_{E_1}, \ldots, luck_{E_B}$ ($0 \le luck_{E_i} \le 10^9$).

The next q lines each describe an operation in the format `C T x c` ($\boldsymbol{T \in \{F, E\}}$, $\mathbf{1 \le x \le n}$, $\mathbf{1 \le c \le 10^{18}}$) or `B k r` ($\mathbf{1 \le k \le 10^{18}}$, $\mathbf{1 \le r \le 10^9}$).

Output

For each `B` operation, output one line. If there are fewer than k corrupted spirits on the map, output `MISS`. Otherwise, if a shiny is encountered, output `SHINY F x` or `SHINY E x`; if not, output `NORMAL F x p` or `NORMAL E x p`, where x is the shiny pool index and p is the pool's current pity counter.

Examples

standard input	standard output
5 2 2 5 10 1 2 1 1 2 2 1 1 2 2 2 2 2 3 40 5 4 41 C E 5 9 C E 4 5 B 2 608984673 B 4 918347739 B 4 37535012 C E 5 7 B 1 712704464 C F 4 7 B 3 270899745 B 5 363752455	NORMAL E 2 1 NORMAL E 1 1 MISS NORMAL E 2 2 NORMAL F 1 1 MISS
3 2 1 3 8 1 1 1 1 2 1 2 3 2 0 5 10 C F 1 2 C E 2 4 B 2 50 C F 3 6 B 3 3 B 5 1 C F 1 2 B 3 100	NORMAL E 1 1 SHINY F 2 MISS NORMAL F 1 1

Note

For sample 2:

Let *F1* denote a corrupted spirit from pool F 1, and *E1* denote a corrupted spirit from pool E 1.

After the first two catch operations, the corrupted spirits on the map are $[F1, E1, E1]$.

Execute `B 2 50`: defeat the 2nd spirit (*E1*). $50 > luck_{E1} = 10$ and $pity = 1 \neq 80$, output `NORMAL E 1 1`.

Then catch the 3rd type of spirit and credit to the family pool, spawning 2 copies of *F2*. Map capacity is 3, so after eviction the map becomes $[E1, F2, F2]$.

Execute `B 3 3`: defeat the 3rd spirit (*F2*). $3 \leq luck_{F2} = 5$, shiny encountered, output `SHINY F 2`.

Execute `B 5 1`: fewer than 5 spirits on the map, output `MISS`.

The last defeat is *F1*, no shiny encountered, output `NORMAL F 1 1`.