Weather Gods

Being a weather god is lousy work. Sunny is too hot, snowy is too cold, rainy is also bad weather, and do not get me started on hurricanes and thunder storms! So the weather gods have decided to screw humans over really bad, and they start with Lea and her best 30 friends. The 31 people are ordered by importance for the gods, from most to least.

Each of those 31 people has a strategy that decides whether they take an umbrella with them or not. After they have made their decision, the *umbrella state* can be represented as a vector of zeroes and ones with length 31.

The gods have various weather strategies at their disposal. Whether or not a strategy causes rain at a person's location can also be represented as zero or one.

If someone carries an umbrella while it does not rain at his location, or does not carry an umbrella and it rains, the gods gain happiness. Again, the happiness can be written as a vector of zeroes and ones, one if they gain happiness from that person and zero if not. Which strategy should the gods choose to maximize that happiness?

Each vector of zeroes and ones will be encoded as a 32 bit integer, the first bit will always be zero, the remaining 31 bits are the vector. Maximizing happiness means maximizing the integer value of the happiness vector.

Input

Before the test cases start, the input contains four integers a c s n describing the weather strategies available. There are exactly n weather strategies $W_1, W_2, \ldots, W_n$ that can be computed from a, c and s as follows:

$$W_1 = s$$
$$W_{k+1} = (a \cdot W_k + c)\%2^{31} \text{ for all } 1 \leq k < n$$

The next line of the input contains an integer t. t test cases follow.

Each test case consists of a single integer u, the umbrella strategy of the 31 people represented as a 32 bit integer.

Output

For each test case, output one line containing "Case #i: x" where i is its number, starting at 1, and x is the strategy that produces maximum happiness, formatted as 32 bit integer. Each line of the output should end with a line break.

Constraints

- $1 \leq a < 2^{31}$
- $1 \leq c < 2^{31}$
- $1 \leq s < 2^{31}$
- $1 \leq n \leq 2 \cdot 10^5$
- $1 \leq t \leq 2 \cdot 10^5$
- $0 \leq u < 2^{31}$

Sample Explanation

Leading zeroes are omitted to ease reading.

In the first sample, the created strategies are $W_1 = 4 = 100_2$ and $W_2 = 5 = 101_2$. The umbrella strategy for case 1 is $3 = 11_2$. The happiness with strategy 1 is $111_2 = 7$, with strategy 2 it is $110_2 = 6$, so strategy 1 is preferable and the output is 4. In case 2, the umbrella strategy is $6 = 110_2$, the happiness for strategy 1 is $010_2 = 2$, with strategy 2 it is $011_2 = 3$, so the output is 5.

In the second sample, the strategies produced are the integers between 1 and 10000. $10000_{10} = 10011100010000_2$. If no person carries an umbrella (umbrella strategy 0), then every strategy produces a 1 at each position it has a 1, so the happiness value is exactly the strategy value. Thus 10000 is best.

If the umbrella strategy is 1, the happiness value is the strategy value with the least significant bit reversed. (so +1/-1 to the strategy value). Thus 10000 again is the best strategy since it produces happiness value 10001. If the umbrella strategy is 10000, then the best strategy has a 1 wherever 10000 has a 0 in binary. The result is 6383.

Sample Input 1

```
1 1 4 2
2
3
6
```

Sample Output 1

```
Case #1: 4
Case #2: 5
```

Sample Input 2

```
1 1 1 10000
5
0
1
16
10000
100000
```

Sample Output 2

```
Case #1: 10000
Case #2: 10000
Case #3: 9999
Case #4: 6383
Case #5: 8543
```

Sample Input 3

```
22695477 7 14529547 100
17
951226548
1333494521
559754673
1922446269
71187083
151402166
1428533273
142569686
1855730595
395531487
1489578778
276656805
1417120511
1179376452
697217383
1443774878
521950742
```

Sample Output 3

```
Case #1: 1205447860
Case #2: 861106633
Case #3: 1577930199
Case #4: 256622911
Case #5: 2047940253
Case #6: 1984033942
Case #7: 719136060
Case #8: 1996549803
Case #9: 295673934
Case #10: 1760296487
Case #11: 652826389
Case #12: 1873120057
Case #13: 716681103
Case #14: 958262648
Case #15: 1450222192
Case #16: 674903720
Case #17: 1637849573
```