

# Black Hole



Given integers  $n$ ,  $a$ ,  $b$  and  $M$ , calculate the value  $\sum_{k=0}^n k^a b^k$  modulo  $M$ .

## Input Format

The first line contains the number of test cases  $T$ .

Each of the next  $T$  lines contains four space-separated integers  $n$ ,  $a$ ,  $b$  and  $M$ .

## Output Format

For each test case output one integer: the value of the sum.

**Note** In this problem we take  $0^0 = 1$

## Constraints

$$1 \leq T \leq 6^6 + 6$$

$$0 \leq n \leq 10^{18}$$

$$0 \leq a \leq 777$$

$$0 \leq |b| \leq 10^{18}$$

$$1 \leq M \leq 10^9$$

The sum of all  $a$  in one test file doesn't exceed 1000

## Sample input

```
5
3 1 1 100
3 0 1 100
3 1 0 100
44 44 4 444
77 7 47 747
```

## Sample Output

```
6
4
0
288
288
```

## Explanation

$$0^1 \times 1^0 + 1^1 \times 1^1 + 2^1 \times 1^2 + 3^1 \times 1^3 = 0 + 1 + 2 + 3 = 6$$

$$0^0 \times 1^0 + 1^0 \times 1^1 + 2^0 \times 1^2 + 3^0 \times 1^3 = 1 + 1 + 1 + 1 = 4$$

$$0^1 \times 0^0 + 1^1 \times 0^1 + 2^1 \times 0^2 + 3^1 \times 0^3 = 0 + 0 + 0 + 0 = 0$$