Birthday Triplets

HackerRank

Julia received a really simple function, f, for her birthday! The function is defined as:

$$f_n = a^n + b^n + c^n$$

Here, a, b, c, and n are positive integers and $a < b < c$. Unfortunately, she forgot the values of a, b, and c; however, she *does* remember the values of f_2, f_3, and f_4!

Julia wants your help finding the triplet $(a,\ b,\ c)$ so she can calculate the value of f_n. If there is more than one such triplet, then she always chooses the one with the smallest value of a; if there are still many such triplets, then she chooses the one with the smallest value of b.

You are given q queries, where each query consists of f_2, f_3, f_4, l, and r. For each query, find the value of $S \bmod (10^9 + 7)$ and print it on a new line, where S is defined as:

$$S = \sum_{n=l}^{r} f_n$$

Note: It is guaranteed that the triplet $(a,\ b,\ c)$ always exists for the given values of f_2, f_3, and f_4.

Input Format

The first line of the input contains an integer, q, denoting the number of queries.
Each of the q subsequent lines contains five space-separated integers describing the respective values of f_2, f_3, f_4, l, and r for a query.

Constraints

- $1 \leq q \leq 2500$
- $6 \leq f_1 \leq 15 \times 10^3$
- $1 \leq l \leq r \leq 10^{15}$

Output Format

For each query, print the value of $S \bmod (10^9 + 7)$ on a new line.

Sample Input 0

```
4
14 36 98 5 6
49 251 1393 7 10
14 36 98 6 9
49 251 1393 8 8
```

Sample Output 0

```
1070
72592824
30124
1686433
```

Explanation 0

The breakdown below describes the *first* and *last* queries:

- $f_2 = 14$, $f_3 = 36$, $f_4 = 98$, $l = 5$, and $r = 6$

For this query, the triplet is $(a = 1,\ b = 2,\ c = 3)$. From this, we calculate:

$$S = \sum_{n=5}^{6} (1^n + 2^n + 3^n) = \left(1^5 + 2^5 + 3^5\right) + \left(1^6 + 2^6 + 3^6\right)$$

$$\Rightarrow S = (1 + 32 + 243) + (1 + 64 + 729) = 276 + 794 = 1070$$

We then print the value of $1070 \bmod (10^9 + 7) = 1070$ on a new line.

- $f_2 = 49$, $f_3 = 251$, $f_4 = 1393$, $l = 8$, and $r = 8$
  For this query, the triplet is $(a = 2,\ b = 3,\ c = 6)$. From this, we calculate:

$$S = \sum_{n=8}^{8} (2^n + 3^n + 6^n) = \left(2^8 + 3^8 + 6^8\right)$$

$$\Rightarrow S = (256 + 6561 + 1679616) = 1686433$$

We then print the value of $1686433 \bmod (10^9 + 7) = 1686433$ on a new line.