Colourful Tiles

Lab Exam 2

Computer Programming
Date: 25 November, 2019

Problem Code: **P5 [25 Marks]**

Problem Statement: Tom the painter wants to build a grid of size 1 X N. In order to build the grid, he can only use smaller blocks available. There are 3 types of blocks available, 1 x 1, 1 x 2 and 1 x 3. Additionally, Tom has n1 distinct colors available for block of size 1 x 1, n2 for block 1 x 2 and n3 for size 1 x 3 (all these n1, n2 and n3 colors are distinct). Tom is thinking that in how many distinct ways can he build the grid? One arrangement is considered different from other if either size of block used or the color of block used differs at any position in the complete grid. Report answer modulo $(10^9 + 7)$.

Input
First line of the input denotes the total number of test cases T. Each of the next T lines contains N, $n1$, $n2$ and $n3$ denoting the size of the grid and the distinct colors of blocks available for 1 x 1, 1 x 2 and 1 x 3 respectively.

Output
A single integer denoting the number of distinct ways to construct the grid modulo $10^9 + 7$

Constraints
$1 \leq T \leq 100$
$1 \leq n1, n2, n3 \leq 1000$

Subtasks 1 (10 points)$1 \leq N \leq 10^5$
Subtasks 2 (15 points)$1 \leq N \leq 10^9$

Time Limit: 1 sec
Memory Limit: 256 MB

Sample Test Case

Input	Output
4 3 1 1 1 2 1 1 2 3 1 2 1 1 1 100 100	4 2 6 1

Explanation : In the first case, we have 1 block of type 1 (1 x 1), 1 block of type 2 (1 x 2) and 1 block of type 3 (1 x 3). Let's say the color of these blocks are Red, Green and Blue respectively. All possible ways to build grid of size 3 are
1. R (1x1), R(1x1), R(1x1)
2. R (1x1), G(1x2)
3. G (1x2), R(1x1)
4. B (1x3)