

UCF “Practice” Local Contest — Aug 23, 2014

A Constant Struggle

filename: constant
(Difficulty Level: Hard)

Your math teacher Xavier Guha has given your class an extra credit assignment to work on. The problem he gives is as follows: Given a linear equation of the form

$$c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 + c_5x_5 + c_6x_6 + c_7x_7 + c_8x_8 = N$$

with c_1, \dots, c_8, N given, he asks you to give the unique solution x (a vector of length 8) to the equation, where each x_i is a non-negative integer. Of course, being a clever student, you realize that depending on the values of c and N , there may be no solution or there may be several solutions. After class, you approach him and inform him of the mistake, but he is stubborn and will not have any of your nonsense.

Having taken several programming classes from his brother, you decide to prove your teacher wrong¹ by writing a program to determine how many solutions the equation has.

The Problem:

Given c_1, \dots, c_8 and N , determine how many unique solutions the equation has. Two solutions p and q are considered unique (different) if there exists some i for which $p_i \neq q_i$. Since you may get this assignment again in the future, your program should be able to solve several instances of the equation.

The Input:

Input will begin with a positive integer T denoting the number of equations to solve. This will be followed by T lines, each containing an instance of the equation to solve. Each instance will be described by 9 space separated positive integers, all ≤ 100 . The first 8 numbers represent c_1, \dots, c_8 , and the 9th number represents N .

The Output:

For each equation, output a single line “Equation # E : S ” where E is the equation number beginning with 1 and S is the number of unique solutions to the equation. It is guaranteed that the value of S will fit in a 64-bit signed integer.

(Sample Input/Output on the next page)

¹ This (proving your teacher is wrong) is generally a bad idea. The author of this problem absolves himself of any (liability for) ill will created between you and your teacher, as well as any detrimental effect this may have on your final course grade. Solve at your own risk.

Sample Input:

```
5
1 1 1 1 1 1 1 1 1
1 2 3 4 5 6 7 8 9
2 4 6 8 10 12 14 16 29
2 4 6 8 10 12 14 17 17
1 1 1 1 1 1 1 1 100
```

Sample Output:

```
Equation #1: 8
Equation #2: 29
Equation #3: 0
Equation #4: 1
Equation #5: 26075972546
```