


































Practice Arena

Practice problems aimed to improve your coding skills.

-  PRACTICE-02_SCAN-PRINT
-  PRACTICE-03_TYPES
-  LAB-PRAC-02_SCAN-PRINT
-  LAB-PRAC-01
-  PRACTICE-04_COND
-  BONUS-PRAC-02
-  LAB-PRAC-03_TYPES
-  PRACTICE-05_COND-LOOPS
-  LAB-PRAC-04_COND
-  LAB-PRAC-05_CONDLLOOPS
-  PRACTICE-07_LOOPS-ARR
-  LAB-PRAC-06_LOOPS
-  LAB-PRAC-07_LOOPS-ARR
-  LABEXAM-PRAC-01_MIDSEM
 -  The D List
 -  The D Factor
 -  All Charged Up
 -  The S Factor
 -  The S List
 -  Smith Numbers
-  PRACTICE-09_PTR-MAT
-  LAB-PRAC-08_ARR-STR
-  PRACTICE-10_MAT-FUN
-  LAB-PRAC-09_PTR-MAT
-  LAB-PRAC-10_MAT-FUN
-  PRACTICE-11_FUN-PTR
-  LAB-PRAC-11_FUN-PTR
-  LAB-PRAC-12_FUN-STRUC
-  LABEXAM-PRAC-02_ENDSEM
-  LAB-PRAC-13_STRUC-NUM
-  LAB-PRAC-14_SORT-MISC

All Charged Up

LABEXAM-PRAC-01_MIDSEM

All Charged Up [75 marks]

Problem Statement

Electrostatic charges (either +1 or -1) have been placed at integer coordinates in a 3D space. The x, y, z, coordinates of these charges can all range from 1 to 256 (both limits included). The charge at a given location (i,j,k) is determined by the following rules

1. Case 1: if the location is at the boundary of this arrangement (i.e. outer surface of this 256 x 256 x 256 sized 3D cube), the charge at that location is +1
2. Case 2: if the location is not at the boundary but the sum $i + j + k$ is prime, then also the charge at that location is +1
3. Case 3: if the location is neither at the boundary, nor is the sum of coordinates prime, but still the coordinates (i,j,k) satisfy the property that the quadratic equation $i * x^2 + j * x + k$ has only real roots, even then the location has charge +1
4. Case 4: any location that does not have charge +1 has charge -1

We will give you two locations (a,b,c) and (p,q,r) with all coordinates in the range [1, 256] (both ends included). Consider the **smallest cuboid C that contains both these locations**. Your task is to print the following in **five separate lines**.

1. The number of locations inside or on the boundary of the cuboid C that satisfy case 1
2. The number of locations inside or on the boundary of the cuboid C that satisfy case 2
3. The number of locations inside or on the boundary of the cuboid C that satisfy case 3
4. The number of locations inside or on the boundary of the cuboid C that satisfy case 4
5. The sum of all charges at locations inside or on the boundary of the cuboid C

Problem-specific Words of Caution:

1. The smallest cuboid C that contains the locations (a,b,c) and (p,q,r) may have one or more side lengths zero e.g. the cuboid may be just a flat rectangle.
2. The coordinates of the two points given to you are not necessarily in any particular order. Keep this in mind.

INPUT:

(a,b,c)(p,q,r)

OUTPUT:

case1

```
case2
case3
case4
totalCharge
```

EXAMPLE:

INPUT

(1,1,1)(2,2,2)

OUTPUT:

```
7
0
0
1
6
```

Explanation: All locations in the cuboid C except the location (2,2,2) lie on the boundary and have +1 charge. There are 7 such locations. The location (2,2,2) is neither on the boundary nor is the sum prime nor does the quadratic equation $x^2 + x + 1$ have real roots. Hence the location (2,2,2) has -1 charge. Total charge in the cuboid is $7-1 = 6$.

General Words of Caution

1. **Do not forget to submit your code.** You can submit multiple times. Your last submission will get graded.
2. Marks will be allotted for the following

1. Proper and meaningful variable names

2. Nice looking and consistent indentation

3. At least a couple of comments explaining to the human grader what are you doing, especially when the calculations are not obvious

4. Comments, good indentation and meaningful variable names are very important for the human grader to understand what are you doing and why. If they cannot understand your code, do not expect them to give you (partial) marks either.

3. Solutions that indulge in hard-coding **will get a straight zero** even if they are passing some test cases. Hard-coding is a form of cheating strategy where someone write code of the form "if(input == A) printf(B)" without doing any calculations on A to obtain B. The values of A and B are either read from the evaluation/submission window or else guessed.

4. Questions will be graded by the **autograder as well as a human grader**

5. Be careful about extra/missing lines and extra/missing spaces if you do not want to lose autograder marks

6. Proportion of marks allotted to autograder (in particular, weightage to visible and hidden test cases) and human grader will be revealed when marks and grading rubrics are released

7. The total marks of this exam are 150.

8. You are allowed to use the libraries `math.h` and `stdlib.h` **but not any other library**. Use of unpermitted libraries will carry a penalty. You may use programming tools such as arrays, functions, recursion, pointers, in case you are familiar with the use of these. However, you will be given no special credit for using these advanced programming techniques, nor will you receive any help should you face difficulties in using them, for example, TLE or segmentation fault errors. Use these advanced techniques at your own risk.

Grading Scheme:

Total marks: **[75 Points]**

There will be partial grading in this question. There are five lines in your output. Printing each line correctly, in the correct order, carries some weightage. The five lines carry 30%, 30%, 10%, 10% and 20% weightage respectively. There are 4 visible and 8 hidden test cases.

Please remember, however, that when you press Submit/Evaluate, you will get a green bar only if all parts of your answer are correct. Thus, if your answer is only partly correct, Prutor will say that you have not passed that test case completely, but when we do autograding afterwards, you will get partial marks.

 **Start Solving!** (</editor/practice/6154>)