

Solved Problem - PnC

In this lesson, we'll discuss a solved PnC Problem.

We'll cover the following

- Problem statement
- Sample
- Solution
- Time Complexity

Problem statement

There are N different types of balls. There are k_1 balls of type 1, k_2 balls of type 2, and so on to k_n . How many ways can you choose 2 balls that are of different types?

Input format

The first line contains one positive integer N ($1 \leq N \leq 10^5$) – the number of types of balls.

The second line contains a sequence k_1, k_2, \dots, k_N where ($1 \leq k_i \leq 10^5$) - the count of balls of each type.

Output format

Print a single integer to answer the problem.

Sample

Input 1

```
3
2 1 1
```

Output 1

Input 2

```
4
1 2 2 2
```

Output 2

```
18
```

Solution

We will subtract the non-desirable number of ways from the totals,

Total number of ways - Pick 2 from $(k_1 + k_2 + \dots + k_n)$ balls





$$A = \binom{k_1 + k_2 + \dots + k_n}{2}$$

Non-desirable case - when both balls are of the same type. The number of ways to pick that is:

$$B = \binom{k_1}{2} + \binom{k_2}{2} + \dots + \binom{k_n}{2}$$

The answer is just $A - B$

Note: Use `long long int` since the result can overflow `int`.

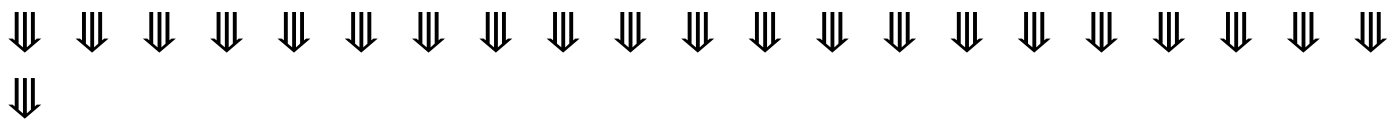
<div>main.cpp</div> <div>input.txt</div>	All code files are copied to end of the page...
<div>     </div>	

Time Complexity

We are looping over the array twice, $O(N)$.

In the next lesson, we'll discuss prime numbers and their properties.

Code Files Content !!!



main.cpp [1]

```
#include
#include
#include

#define lli long long int
using namespace std;

lli number_of_ways(int N, vector K){
    lli total = 0;
    for (auto it : K)
        total += it;
    lli A = (total * (total - 1)) / 2;

    lli B = 0;
    for (auto it : K)
        B += (it * (it - 1)) / 2;

    return A - B;
}

int main() {
    ifstream cin("input.txt");

    int N;
    cin >> N;
    vector K(N);
    for (int i = 0; i < N; i++)
        cin >> K[i];
    cout << number_of_ways(N, K);

    return 0;
}
```

input.txt [1]

3
2 1 1
