

Codeforces

MMUKUL KHEDEKAR

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<https://codeforces.com/problemset/problem/702/B>

Accepted: <https://codeforces.com/contest/702/submission/360122626>

§1 Solution

§1.1 Explanation

Lemma 1.1

There are only 30 powers of two under 2×10^9 .

Let's call this set as \mathbb{P} . Since we want to compute

$$\sum_{i=1}^n \sum_{j=i+1}^n [a_i + a_j \in \mathbb{P}]$$

This could be written as

$$\frac{1}{2} \left(\sum_{1 \leq i, j \leq n} [a_i + a_j \in \mathbb{P}] - \sum_{1 \leq i \leq n} [2 \cdot a_i \in \mathbb{P}] \right)$$

Iterating over i, j would explode to $\mathcal{O}(n^2)$. However instead, if we iterated over i and powers of two in \mathbb{P} and check if that exists in a then that would be $\mathcal{O}(30n \log n)$.

§1.2 Code

```
1 void solve() {
2     ll n;
3     std::cin >> n;
4
5     std::vector<ll> a(n + 1);
6     std::map<ll, ll> mp;
7     for (ll i = 1; i <= n; i++) {
8         std::cin >> a[i];
9         mp[a[i]]++;
10    }
11
12    std::vector<ll> powers;
13    for (ll i = 2; i <= 2 * 1e9; i *= 2) {
14        powers.push_back(i);
15    }
16 }
```

```

17  ll ans = 0;
18  for (ll i = 1; i <= n; i++) {
19      for (auto sum: powers) {
20          if (mp.count(sum - a[i])) {
21              ans += mp[sum - a[i]];
22              if (sum == 2 * a[i]) {
23                  ans--;
24              }
25          }
26      }
27  }
28
29  ans /= 2;
30  std::cout << ans << '\n';
31 }

```

§1.3 Performance Optimizations

If instead of

```

1  if (mp.count(sum - a[i])) {
2      ans += mp[sum - a[i]];
3      if (sum == 2 * a[i]) {
4          ans--;
5      }
6  }

```

we had

```

1  ans += mp[sum - a[i]];
2  if (sum == 2 * a[i]) {
3      ans--;
4  }

```

then that leads to a 10x slower running time. This is because of [how](#) the `[]` operator works on ordered maps.

If the key does not exist, a pair with that key is created using default values, which is then returned.

360122626	Jan/27/2026 15:40 ^{UTC+5.5}	kh4rg0sh	C++23 (GCC 14-64, msys2)	Accepted	296 ms	3900 KB
360122226	Jan/27/2026 15:37 ^{UTC+5.5}	kh4rg0sh	C++23 (GCC 14-64, msys2)	Accepted	2734 ms	198200 KB

Figure 1: performance of both the submissions