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Section → KRG-2B __/__/____

(1) we define f(x, y) as a number of different corresponding bits in the binary representation of x and y.

You are given an array of N positive integers. Find sum of all pairs (i, j) such that $1 \le i, j \le N$. Return the answer modulo 10^8+7.

Input: 1.
A = [1, 3, 5]
output = 8

Input 2:
A = [2, 3]
output : 2.

(9/4)

Algo:-

(i) we have two numbers

(ii) we will take XOR of both number (in binary bits)

(iii) After that we can count the no. of set bits from the 'XOR' output

(iv) the number of set bit is the answer.

→ Brute force:-

```
#define mod = 10^8 + 7
int f(x, y) {
    int num = x ^ y;
    while (num != 0) {
        if (num & 1 == 1) count = (count + 1) % mod;
        num = num >> 1;
    }
    return count;
}

main() {
    for (int i = 0; i < n; i++) {
        for (int j = i + 1; j < n; j++) {
            ans += f(nums[i], nums[j]) % mod;
}
```

Time complexity → $O(N^2 \log n)$

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→ Optimal approach

```
long long solve (vector<int> &A) {
        long long mod = 1e^8 +7;
        long long n = A.size();
        long long ans=0;
    for (int b=0; b<32; b++) {
        for (int i=0; i<n; i++) {
            if (A[i] & (1LL<<b)) ones++;
        }

        long long zeros = n - zeros;
        ans =(ans +((ones * zeros) % mod) * 2)) % mod;
    }
}
```

Time complexity (O(N*32))