2 mins

Q =) 1 You will be given n numbers. You have to find sum of two digits of all of possible pairs from the given n numbers.

$(N \le 10^6)$ $A_i \le 10^9$

Ex → Input →

3

1 2 3

$(1\times2 + 2\times3 + 1\times3)$

$(2 + 6 + 3)$

Output → 11

Brute force → to take the sum of product of all pairs we can generate all the pairs & take product of each of them & finally take a sum.

for n number → n^2 operation $n \le 10^6$ 10^{12}

all n number

```
for (int i=0; i<n-1; i++){
    for (int j=i+1; j<n; j++){
        cout << a[i] << " " << a[j];
    }
}
```

For n numbers →

$(a_1 \times a_2 + a_1 \times a_3 + a_1 \times a_4 - - - - - - -)$

$[(a+b)^2 = a^2 + b^2 + 2ab]$ ✓

$[(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca]$

$(a+b+c \cdots\cdots)^2 = (a^2 + b^2 + c^2 + d^2 - - - -) +$

$(2ab + 2bc + 2ca + 2db - - - - -)$

$$(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$$

$$\left[\frac{(a+b+c)^2-a^2-b^2-c^2}{2}\right] = (ab+bc+ca)$$

$$\frac{(a+b+c+d \ldots)^2-a^2-b^2-c^2-d^2 \ldots}{2} = \text{Sum of products of all pairs}$$

Sum $+= a$

square_sum $+= a^2$

$\rightarrow$ Sum $+= b$

Square $+= b^2$

$2n$

$\times$ M

$n \to$ operation $\to \log_2 n$

$a \Rightarrow a^b$ Implement $\to$ loops

$a^b = a^{b/2} \times a^{b/2}$

$a^{b/2} = a^{b/4} \times a^{b/4}$

$a^{b/4} = a^{b/8} \times a^{b/8}$

$\vdots$

$a^4 \quad a^2 \times a^2$

$a^2 = a^1 \times a^1$

K term

$\frac{b}{2^k} = 1$

$k = \log_2 b$

$K = \log_2 b$

2^{5}

b key odd → we should multiply final result by 2

$\hookrightarrow 2 \times 2 \to 2^{2}$

$2^{2} \times 2^{2} \to 2^{4} \times 2$

$2^{5} \to 2 \times 2^{4}$

$3^7 \rightarrow$

2 2

a	b	res
3	7	1
3	7	3
9	3	3
9	3	27
81	1	27
81	1	27×81
~~243~~ 81×81	0	27×81 $3^3 \times 3^4 = 3^7$

3^6

$a = a^1 \times a^1$

$a = a \times a$

$a = a^2 \times a^2$

$a = a^4 \times a^4$

a	b	res
3	6	1
9	3	1
9	3	9
81	1	9
81	1	9×81
81×81	0	9×81

$3^2 \times 3^4 = 3^6$

① n '21784' ⟶ reverse ⟶ 48712

2 mins

ans = 0

↪ one by one extract the rightmost digit and append it in a new number.

$d = n \% 10$ ⟶ Rightmost digit

4

$ans = ans * 10 + d$

$n = n/10$

0×10+4

n=n/10

4×10+8

n = 21784

ans = 0

48*10+7

2178

217

21

4

48

487

0

217 ← 2178/10

ans

print

$$\underbrace{0,\ 2,\ 8,\ 34,\ 144,\ 610,\ 2584,\ 10946 \ldots\ldots}$$

Even fibonacci series term

Every 3rd term is even

For any fib

$$f_n = f_{n-1} + f_{n-2}$$

$\rightarrow 2 \rightarrow 2^{nd}$ fib → 2^{nd} last even term

$\rightarrow 8 \Rightarrow 3^{rd}$ fib ← last even term

$34 \rightarrow 8^{th}$ fib

$$f_8 = f_7 + f_6$$

$$= f_6 + f_5 + f_5 + f_4$$

$$= 2f_5 + f_6 + f_4 = 2f_5 + f_5 + f_4 + f_3 + f_2$$

$$= 3f_5 + \underbrace{f_4 + f_3}_{f_5} + f_2 = 4f_5 + f_2$$

Let denote $g(n)$ gum the sum then fibonacci

$$g(n) = 4\,g(n-1) + g(n-2)$$

↳ Q ⇒ Given a number n. Find the number of trailing zeros in n!

Ex → n = 5 ans → 1 5! = 120

n = 4 ans ⇒ 0

Calc the trailing zeros in $n!$ $= n \times n-1 \times n-2 \times n-3 \cdots\cdots 1$

As we know every no. x can be represent as product of power of prime.

$$\left(x = p_1^{a_1} \times p_2^{a_2} \times p_3^{a_3} \cdots\right)$$

$5! = 5 \times 4 \times 3 \times 2 \times 1$

$\to 5 \times 1 \times 2 \times 2 \times 1 \times 3 \times 1 \times 2 \times 1 \times 1$

$\to 5^1 \times 2^3 \times 3^1$ $\quad (5 \times 2) = 10$

to add a trailing zero we need to multiply a number of 10

$10 \to 5 \times 2$

The no. of pairs of 5, 2 that we can have will give us the no. of trailing zeroes

For any number $n!$ how can we calc the no. of factors of n

$4!$

$$\frac{24}{5}$$

$$5 \overline{)120}$$

24

1

120

$$n! \Rightarrow \left\lfloor \frac{n}{5} \right\rfloor + \left\lfloor \frac{n}{5^2} \right\rfloor + \left\lfloor \frac{n}{5^3} \right\rfloor - - - - - -$$

$\Rightarrow$ factors of 5 in $n!$

$$20! \Rightarrow \quad \underline{4} \rightarrow \text{trails}$$

$$\left\lfloor \frac{20}{5} \right\rfloor + \left\lfloor \frac{20}{5^2} \right\rfloor + \left\lfloor \frac{20}{5^3} \right\rfloor - - - -$$

$$\qquad 4 \qquad\qquad \times 0 \qquad\qquad \times 0$$

Q ⇒ You will be given N numbers where N is odd. Among those numbers, every no. appears twice but only one no. appears once. Find the unique number.

$N \le 10^8$

Ex $N = 5$

2 2 17 17 3 → unique no.

ans → 3

2 2 2 2 2

2, 2, 17, 3, 17

optimum

arrange these no.'s in asc order → sorting

2 2 3 17 17

$n \log n$

(XOR) ⇒ xor of 2 no's when both the no.'s are equal then it gives 0

$$\begin{array}{r} 1\,0 \\ \wedge\ 1\,0 \\ \hline 0\,0 \end{array} \rightarrow 0$$

2 2 2 2 2

2 2 5 3 5

x = 00 — 0

x = 10 → 2

x = 00 → 0

x = 101 → 5

x = 110 → 6

x = 011 → 3

$$\begin{array}{r} 101 \\ 011 \\ \hline 110 \end{array}$$

$$\begin{array}{r} 110 \\ 101 \\ \hline 01\cancel{0} \end{array}$$

Q →

for loops

n = 4

```
      *
    * * *
  * * * * *
* * * * * * *
```

Q →

n = 4

```
      1
    1 2 1
  1 2 3 2 1
1 2 3 4 3 2 1
```