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2 mins

Q<sub>1</sub> You will be given  $n$  numbers. You have to find sum of <sup>product of</sup> all possible pairs from the given  $n$  numbers.

ex  $\rightarrow$  Input  $\rightarrow$  3  
1 2 3

Output  $\rightarrow$  11

$$\begin{aligned} & \underline{\underline{(N \leq 10^6)}} \quad \underline{\underline{A_i \leq 10^9}} \\ & (1 \times 2 + 2 \times 3 + 1 \times 3) \\ & (2 + 6 + 3) \end{aligned}$$

# Brute force  $\rightarrow$  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  $\rightarrow$   $n^2$  operation  $n \leq 10^6$   $10^6$

all  $n$  number  $\leftarrow$   $\left[ \begin{array}{l} \text{for (int } i=0; i < n-1; i++) \{ \\ \quad \text{for (int } j=i+1; j < n; j++) \{ \\ \quad \quad \text{cout} << a[i] << " " << a[j]; \\ \quad \quad \underline{\underline{\quad}} \end{array} \right]$

$\left. \begin{array}{l} \leftarrow \\ \leftarrow \end{array} \right\} \begin{array}{l} \text{3} \\ \text{3} \end{array}$

For  $n$  numbers  $\rightarrow$

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

$$[(a+b)^2 = a^2 + b^2 + 2ab] \quad \checkmark$$

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

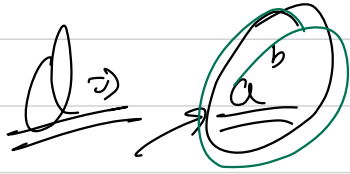
$$(a+b+c+\dots)^2 = (a^2 + b^2 + c^2 + d^2 + \dots) + (2ab + 2bc + 2ca + 2db + \dots)$$

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

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

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

$$\left[ \begin{array}{l} \text{Sum } t = a \\ \text{square-sum } t = a^2 \end{array} \right] \rightarrow \left[ \begin{array}{l} \text{Sum } t = b \\ \text{square-sum } t = b^2 \end{array} \right] \quad 2n \times n$$



$n \rightarrow \text{operations} \rightarrow \log_2 n$   
 Implement  $\rightarrow$  loops

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

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

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

$\vdots$

$a^4 = a^2 \times a^2$

$\hookrightarrow \underline{a^2} = \underline{a^1} \times \underline{a^1}$

K term

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

$k = \log_2 b$

$K = \log_2 b$



b key odd  $\rightarrow$  we should multiply  
final result by 2

$$\begin{aligned} & \hookrightarrow 2 \times 2 \rightarrow (2^2) \\ & 2^2 \times 2^2 \rightarrow (2^4) \times 2 \\ & 2^5 \rightarrow 2 \times (2^4) \end{aligned}$$

$$\underline{\underline{3}}^a \rightarrow$$

$$\underline{\underline{a}} \\ \underline{\underline{3}}$$

$$\underline{\underline{b}} \\ \underline{\underline{7}}$$

$$\begin{array}{r} 22 \\ \underline{\underline{(812)}} \\ 1 \end{array}$$

$$\begin{array}{r} 3 \\ \rightarrow 9 \\ \underline{\underline{=}} \end{array}$$

$$\begin{array}{r} 7 \\ \rightarrow (3) \\ \underline{\underline{=}} \end{array}$$

$$3$$

$$3$$

$$\begin{array}{r} 9 \\ \rightarrow 81 \end{array}$$

$$\begin{array}{r} 3 \\ \underline{\underline{1}} \end{array}$$

$$27$$

$$27$$

$$\begin{array}{r} 81 \\ \rightarrow 27 \times 3 \\ \underline{\underline{61 \times 81}} \end{array}$$

$$\begin{array}{r} 1 \\ 0 \end{array}$$

$$\begin{array}{r} 27 \times 81 \\ \underline{\underline{27 \times 81}} \\ 3^2 \times 3^4 = 3^6 \end{array}$$



$$3^6$$

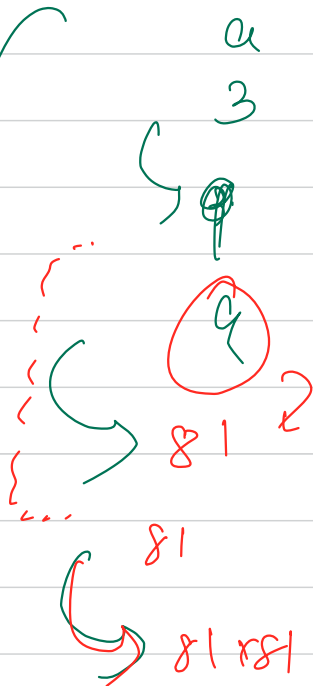
$$a = a^1 \times 9$$

$$a = a^1 \times 9^1$$

$$a = a^2 \times 9$$

$$a = a^2 \times 9^2$$

$$a = a^4 \times 9^4$$



$$\begin{array}{r} b \\ 3 \\ 3 \\ 1 \\ 1 \\ 0 \end{array}$$

$$\text{res} \\ 1$$

$$1$$

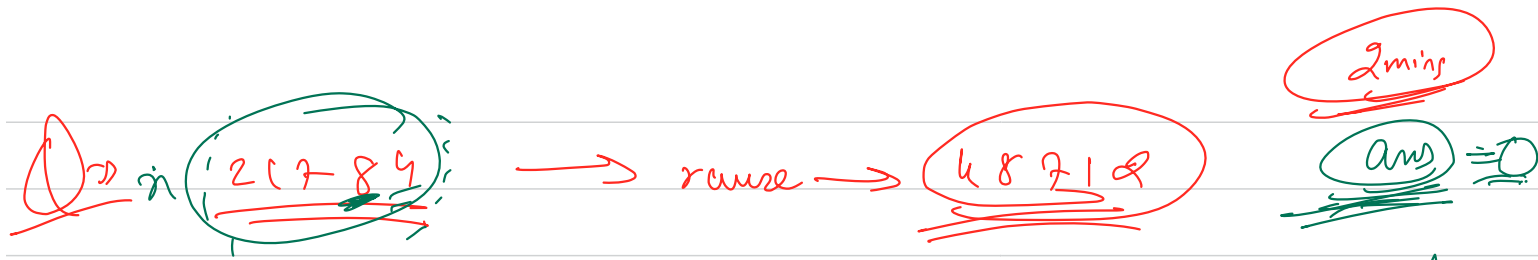
$$9$$

$$9$$

$$9 \times 81$$

$$\begin{array}{r} 9 \times 81 \\ 81 \times 81 \end{array}$$

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



$\hookrightarrow$  one by one extract the rightmost digit and  
 append it in a new number.

$\textcircled{1} = n \% 10 \rightarrow$  rightmost digit

4

$$\text{ans} = \text{ans} * 10 + d$$

$$\text{n = n / 10}$$

$n = 21784$

$2178$

$217$

$21$

$2$

$0 \times 10^4$   
 $n = n/10$   
 $0$   
 $4$

$48$

$4 \times 10^4$

$48 \times 10 + 2$

$487$

$217$   $\leftarrow 2178/10$   
 $2$   $\leftarrow$   $217$   
 $print$

0, 2, 8, 34, 144, 610, 2584, 10946, ...



Even fibonacci series term

Every 3<sup>rd</sup> term is even

for any fib

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

$\rightarrow 2 \rightarrow 2^{\text{nd}}$  fib  
 $\rightarrow \underline{8} \rightarrow 8^{\text{th}}$  fib  
 $34 \rightarrow 8^{\text{th}}$  fib

$\rightarrow 2^{\text{nd}}$  last even term  
 $\leftarrow$  last even term

$$f_8 =$$

$$\underline{f_7} + \underline{f_6}$$

$$= \underline{f_6} + \underline{f_5} + \underline{f_5} + \underline{f_4}$$

$$= \underline{2f_5} + \underline{f_6} + \underline{f_4} = 2f_5 + \underline{f_5} + \underline{f_4} + \underline{f_3} + \underline{f_2}$$

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

Let denote  $g(n)$  give the even term fibonacci

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

↳ Ques Given a number  $n$ . Find the number of trailing

zeros in  $n!$

Ex  $\rightarrow n = 5$

ans  $\rightarrow 1$

$5! = 120$

$n = 4$

ans  $\rightarrow \underline{\underline{0}}$

Calc the leading zeros in  $n!$   $= \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1} \times \dots \times \frac{2}{1}$

& we know ever no.  $x$  can be represent as product of power of prime  $(x = p_1^{a_1} \times p_2^{a_2} \times p_3^{a_3} \dots)$

$$S_1 = \int x^4 x^3 x^2 x^1$$

$$\rightarrow S \times (x \times 2 \times 2 \times 1 \times 3 \times 1 \times 2 \times 1 \times 1)$$

$\rightarrow 2^2 \ 1^2 \ 2^2 \ 3^1$

$S_{12} \approx 10$

to add a binary  
zero we need  
to multiply a number  
by  $(10)$   
 $(10) \rightarrow 5 \times 2$



the no. of pairs of 1, 2 that we can have will give  
us the no. of trailing zeros

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

$$4!$$

$$\begin{array}{r} 24 \\ \times 5 \\ \hline 120 \end{array}$$

$$5! = 120$$

$$24 \times 5 = 120$$

$$120$$

↓

$\frac{21}{1} \rightarrow \left[ \frac{n}{s} \right] + \left[ \frac{n}{s^2} \right] + \left[ \frac{n}{s^3} \right] + \dots$

$\rightarrow$  factor of  $s$  in  $n!$

$\frac{20}{1} \rightarrow \frac{4}{\rightarrow \text{body}}$

$\left[ \frac{20}{s} \right] + \left[ \frac{20}{s^2} \right] + \left[ \frac{20}{s^3} \right] + \dots$

$\downarrow$   
4

$\downarrow$   
4

$\downarrow$   
4

Q  $\Rightarrow$  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.

$$N \leq 10^5$$

Ex

$$N=5$$

2 2 17 17

(3)

unique no.

ans  $\rightarrow$  3

2 2 2 2 2  
 2, 2, 17, 3, 17

Optim

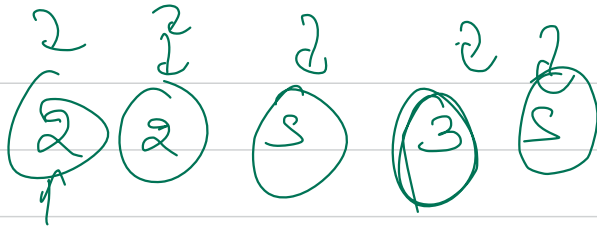
arrange these no.'s in asc order →

(2 2) (3) (17) 17

Sorting  
n log n

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

$$\begin{array}{r} 10 \\ \wedge 10 \\ \hline 00 \rightarrow 0 \end{array}$$



$$x = 00 \rightarrow 0$$

$$x = 10 \rightarrow 2$$

$$x = 01 \rightarrow 0$$

$$x = 101 \rightarrow 5$$

$$x = 110 \rightarrow 6$$

$$x = 011 \rightarrow 3$$

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

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

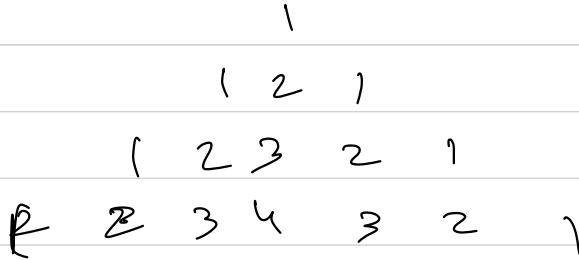
Q2



→ for loops

↪ n = 4

Q3



↪ n = 4