Introduction to Programming

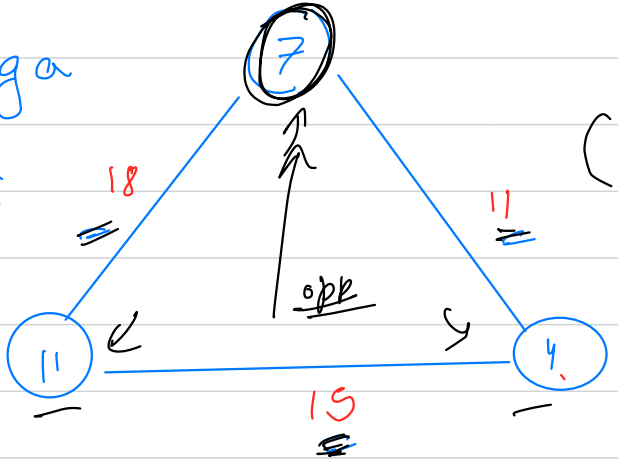
Arithmagon Problem

$18 + 11 + 15 = 44$

$(v_1+v_2) + (v_2+v_3) + (v_3+v_1)$

For any given polygon

how can we solve it



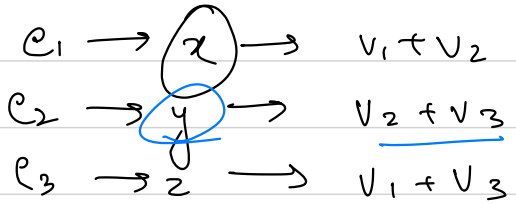
$\frac{44}{2} - 15$

$\Rightarrow 22 - 15 = 7$

(x, y, z)

for the given x, y, z where $(x, y, z) \rightarrow$ edge wts

Let sum up the edge wts $\Rightarrow$ $x+y+z$



$x + y + z \rightarrow$ Sum $\leftarrow (v_1 + v_2) + (v_3 + v_2) + (v_1 + v_3)$

$$x + y + z = 2(v_1 + v_2 + v_3)$$

$$v_1 + v_2 + v_3 = (x + y + z)/2$$

$$v_1 + v_2 + v_3 = (x+y+z)/2$$

for any vertex, Let take v_3

$$v_3 = (x+y+z)/2 - v_1 - v_2$$

$$v_3 = (x+y+z)/2 - (v_1+v_2)$$

$$v_2 = (x+y+z)/2 - (v_1+v_3)$$

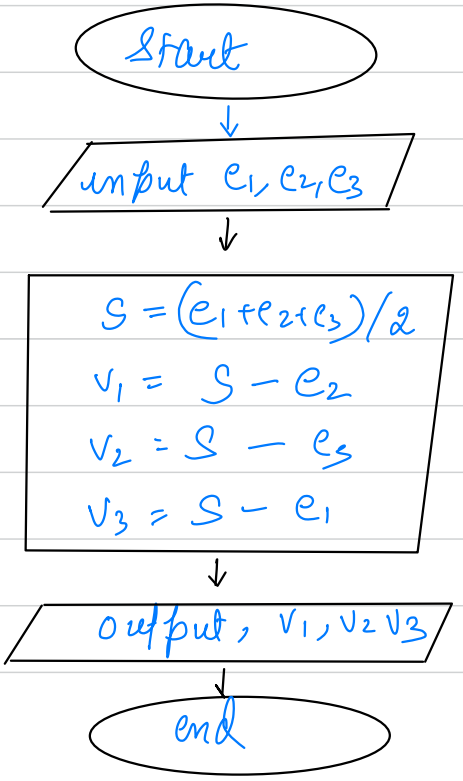
$$v_1 = - - - - -$$

$(v_1+v_2) \rightarrow e_1$

$(v_1+v_3) \rightarrow e_3$

1) → Efficient
2) → Accurate
] → Solve problem

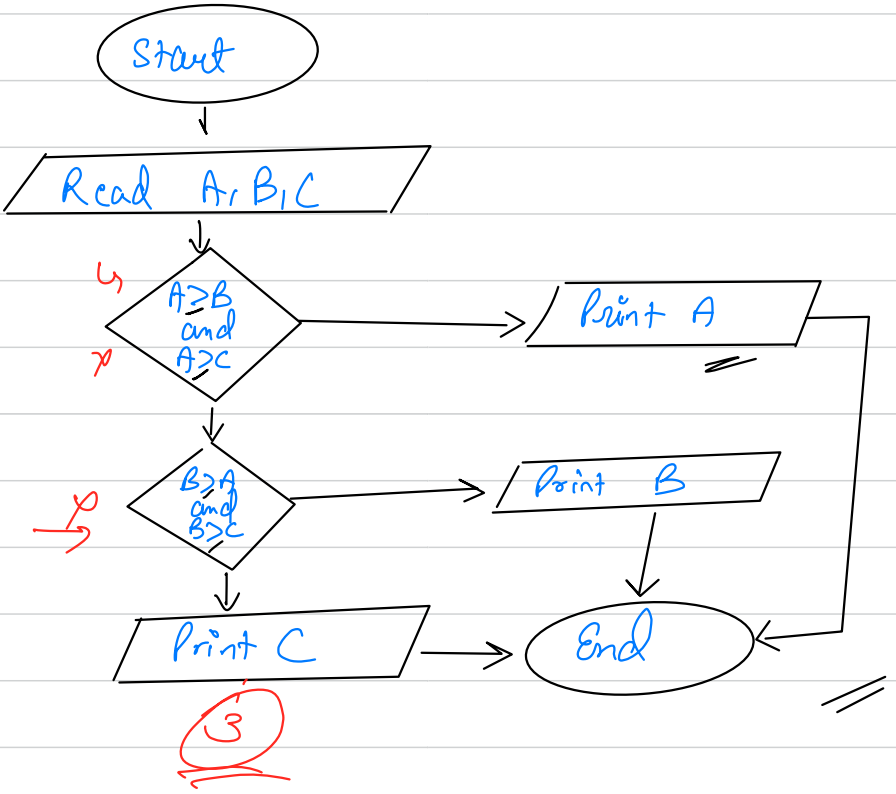
Flowchart for the Arithmagon problem



Find the largest of 3 numbers →

A B C
3, 3, 3

20, 20, 18



3 problems → largest of 3 nos, Arithmagon, Simple Interest

$2 \times 10^8 \leftarrow 10^9$ cycles per sec

fact → combination

operations → programming

time constraint → TLE

→ 1 sec → 10^8

2 sec → 2×10^8

Q) You are given a value N, you have to calculate the sum of natural no.'s upto N where

$N \leq 10^{10}$

$1 + 2 + 3 \ldots\ldots + (N-1) + N$ accurate

Ex → 3 ← i/p

→ 6 ← o/p

for one addition → 1 operation

N → $N \times (N+1)$ / 2 ← $\frac{n}{2}(a + a + (n-1)d)$ 2+3

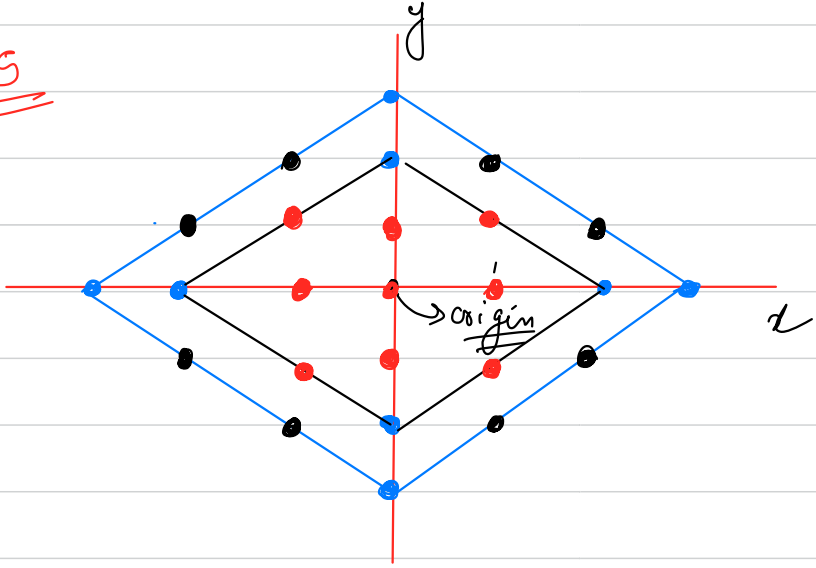
3-4 operation

$\frac{n}{2}(a + a + (n-1)d)$ ← last term

$\frac{1}{2}(1+N)$

Q) You are given a 2D Cartesian plane. You want to find the no. of points having Manhattan Distance atmost 'S' from the origin.

Ex $S = 1 \rightarrow 5$



$S = 0 \rightarrow 1$

$S = 1 \rightarrow 5$

$S = 2 \rightarrow 13$

$S = 3 \rightarrow 25$

for any 2 points on a cartesian plane $P_1(x_1, y_1)$ & $P_2(x_2, y_2)$

manhattan distance = $|x_1 - x_2| + |y_1 - y_2|$

at most $S \rightarrow$

$\rightarrow |0| + |1| + |2| + |3| \cdots\cdots |S|$

$1 + 4 + 8 + 12 \cdots\cdots$

AP

atmost 5

$1 + 4(1 + 2 + 3 \cdots\cdots 5)$ → Sum of first 5 natural no

$1 + \cancel{4}^{2} \times \left(\frac{5 \times (5+1)}{\cancel{2}}\right)$

$1 + 2(5(5+1))$

$1 + 2(3)(4) \rightarrow 25$

Q.1 You will be given a number N. ($N \leq 10^6$). Check if it is a prime number or not ???

Ex → $N = 10$ → No

$N = 7$ → Yes

For being a prime number, you are going to be completely divided by 1 or the yourself itself.

We can start checking from (2 — N-1) that if any number divids N.

↳ 2 —— N-1 ⟶ check if i^{th} no. divides N

N + N ⇒ 2N ≈ N → operation

for N = 36

1 x 36
2 x 18
3 x 12
4 x 9
6 x 6 → Square root
→ 9 x 4
12 x 3
18 x 2
36 x 1

$N \leq 10^{10}$

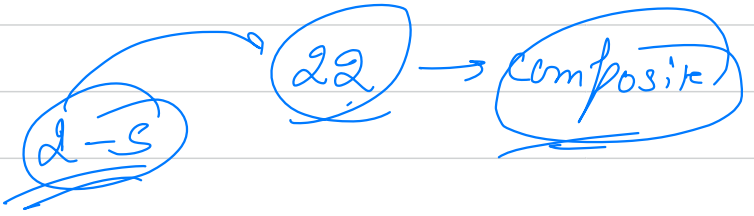
2 ⟶ sqrt(N)

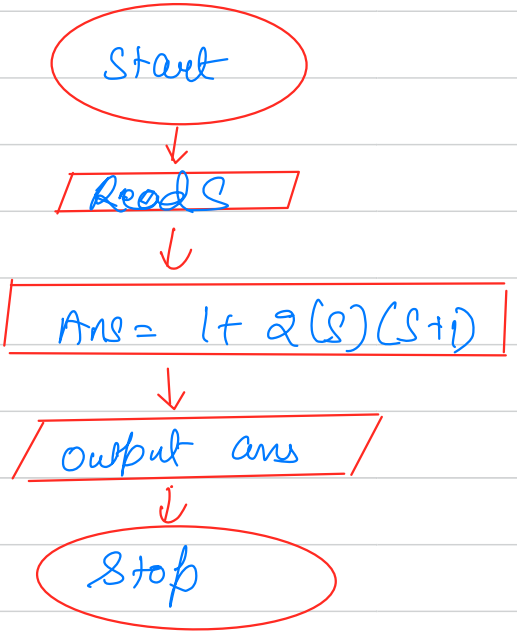
↳ squareroot(N) operation

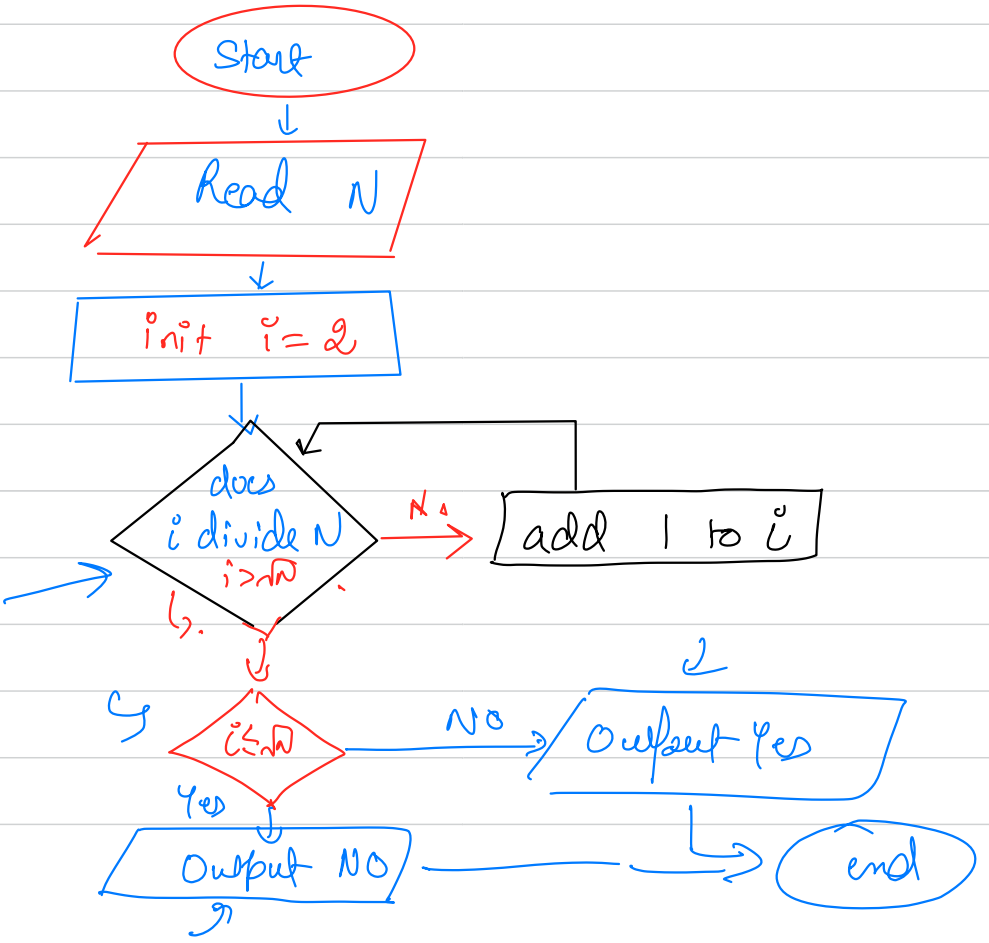
2

29 → prime

2 – 7




Start
Read S
Ans = It a(S)(S+1)
output ans
Stop


Start
Read N
init i=2
does i divide N
i>√N
No
add 1 to i
i≤√N
Yes
No
Output Yes
Output NO
end