
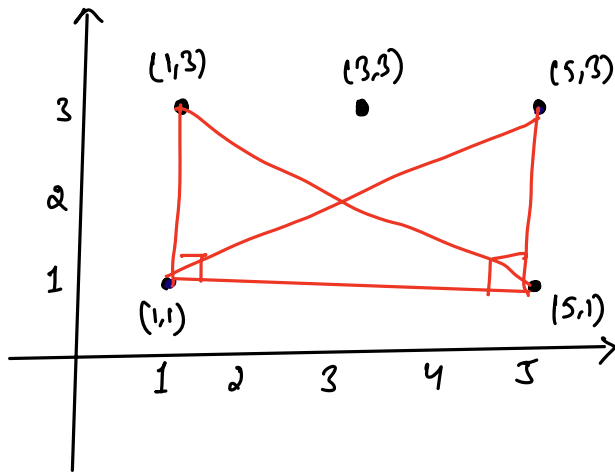


Agenda -

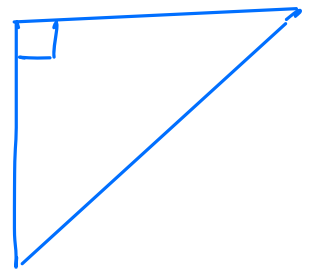
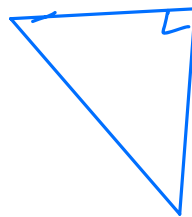
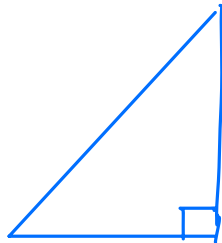
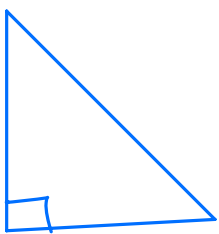
→ Questions on Hashing

Q) Given co-ordinates of N distinct points on a 2D plane. Count the no. of right angled triangle using the given set of points such that two small sides of a  should be parallel to x-axis & y-axis.

$$[1 \leq N \leq 10^5]$$



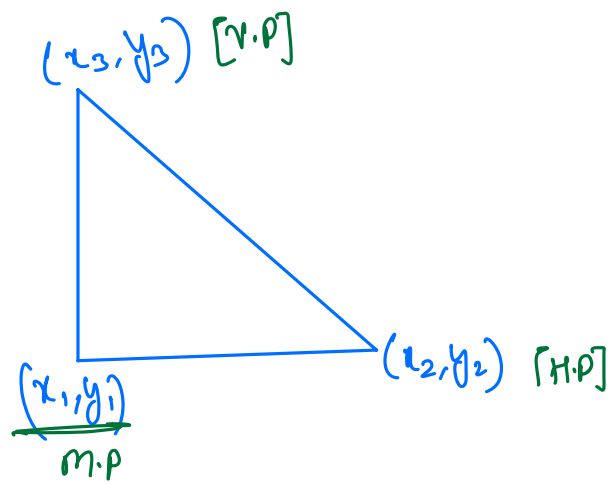
ans = 6.



x →	1	1	3	5	5
y →	3	1	3	3	1

idea. → Consider all the triplets and check if they are forming a right angled triangle or not.

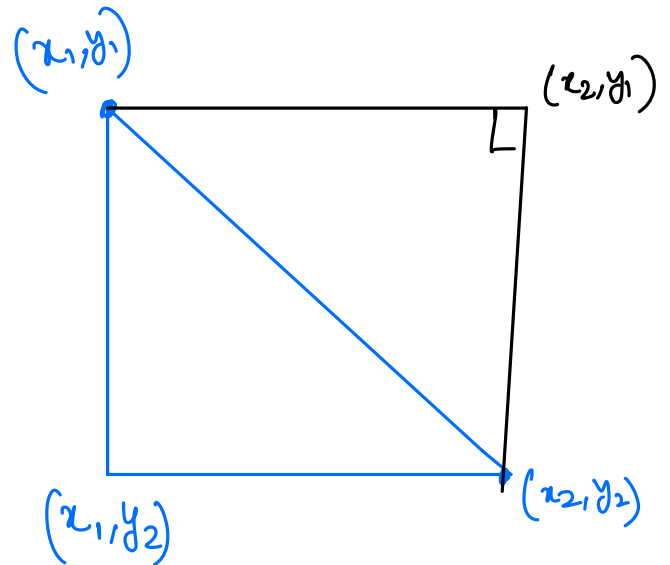
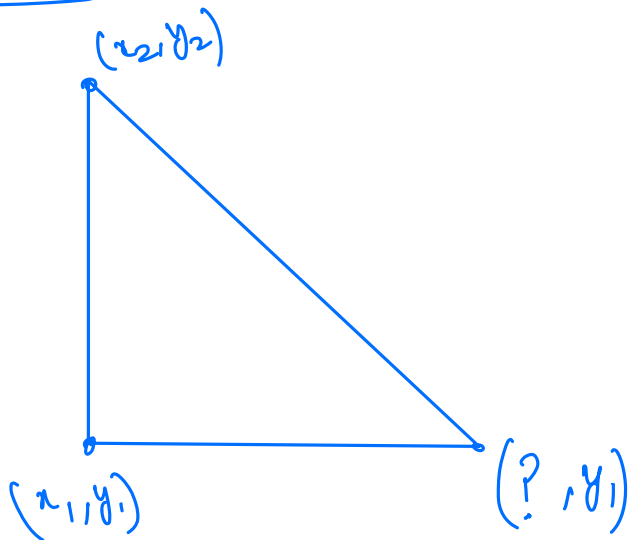
two sides $\left\{ \begin{array}{l} \parallel \text{ x-axis} \\ \parallel \text{ y-axis} \end{array} \right\}$



$$[y_1 == y_2 \ \&\& \ x_1 == x_3]$$

$$\begin{cases} T.C \rightarrow O(N^3) \\ S.C \rightarrow O(1) \end{cases}$$

idea.2.

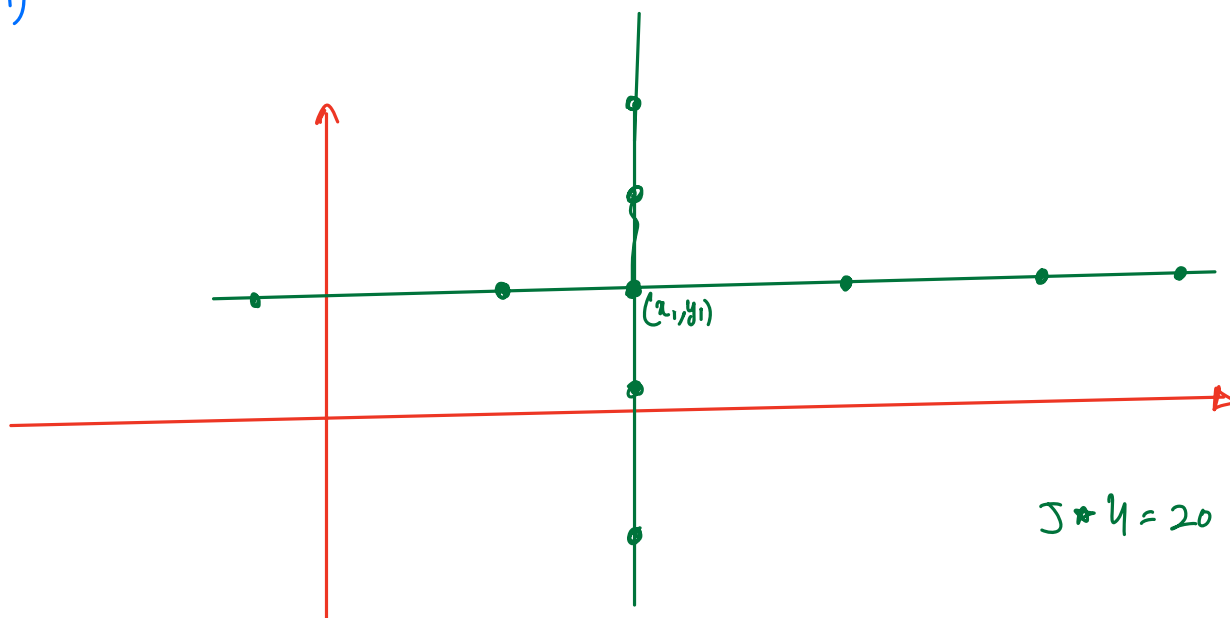
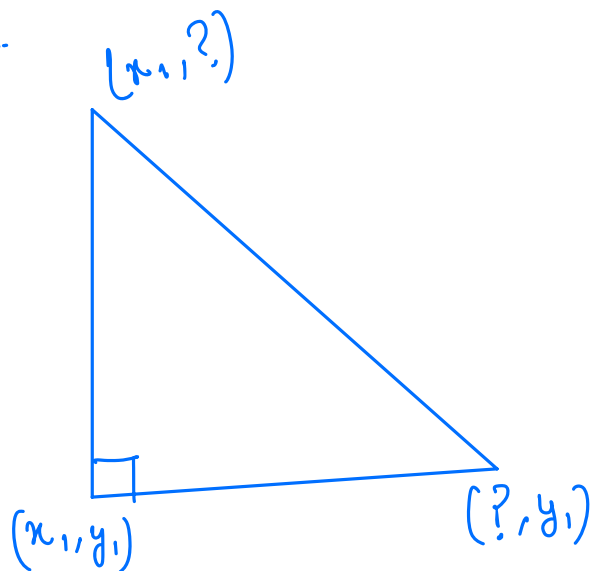


idea. → Consider all the pairs and check for the third point so that a valid right angled triangle is formed.

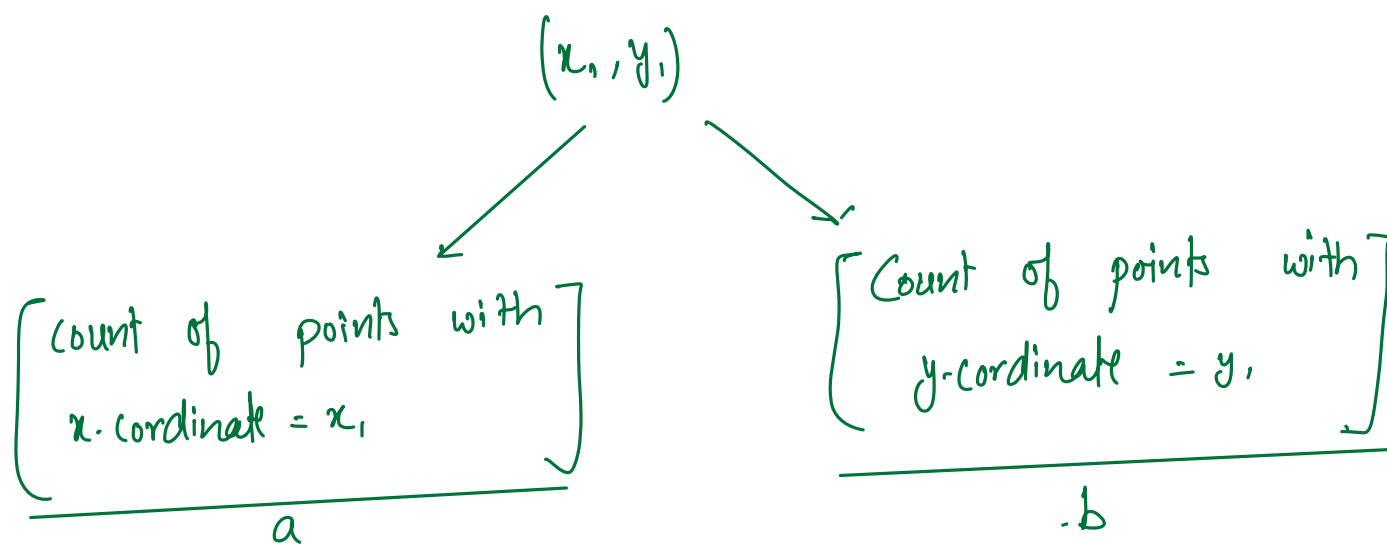
String. → $\{x[i] + "-" + y[i]\}$ → insert this in map/set

$$\begin{cases} T.C \rightarrow O(N^2) \\ S.C \rightarrow O(N) \end{cases}$$

Idea-3

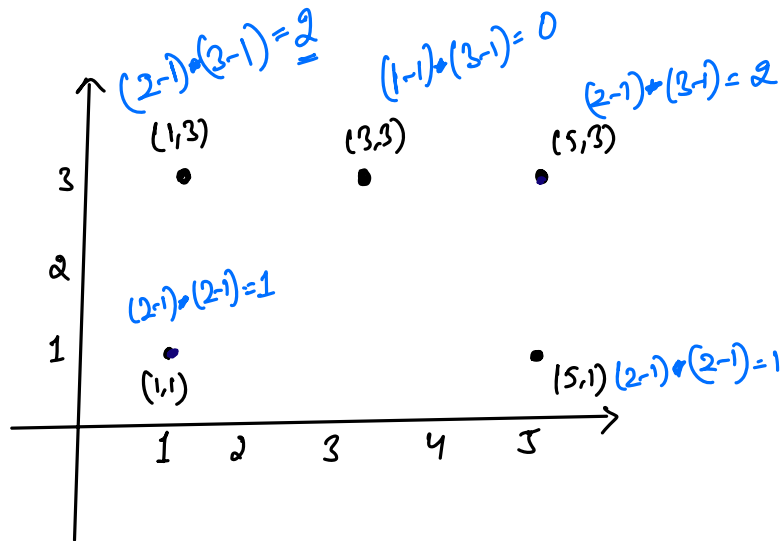


$5 * 4 = 20$ triangles



ans $= (a-1) * (b-1)$

Create two frequency maps \rightarrow frequency of x-coordinate
 \rightarrow frequency of y-coordinate



x \rightarrow	1	1	3	5	5
y \rightarrow	3	1	2	3	1

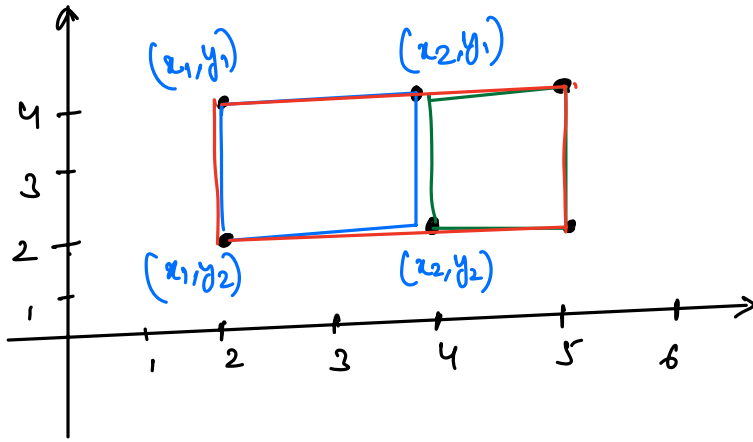
#code:-

- Take two hashmaps \rightarrow hm1 and hm2.
- Store frequency of x-coordinates in hm1
Store frequency of y-coordinates in hm2.

③ ans = 0
for (i = 0; i < N; i++) {
 $C_1 = \text{hm1}[x[i]] - 1;$
 $C_2 = \text{hm2}[y[i]] - 1;$
ans += $(C_1 * C_2);$
}
return ans;

$T.C \rightarrow O(N)$
 $S.C \rightarrow O(N)$

Q Given N points on a 2-D plane. Find count of rectangles we can form such that sides are parallel to x -axis and y -axis.



Ans = 3.

idea → Consider all pairs of (x_1, y_1) and (x_2, y_2) and search for (x_1, y_2) and (x_2, y_1) .

⇒ Using hashset.

String → $\{ x[i] + "-" + y[i] \}$

code →

```
Hashset<String> set;
for (i = 0; i < N; i++) {
    set.insert(new String(x[i] + "-" + y[i]));
}
```

→ todo.

$\left[\begin{array}{l} \text{T.C} \rightarrow O(N^2) \\ \text{S.C} \rightarrow O(N) \end{array} \right]$

Q. Given two strings A and B of length n & m respectively.
Find the minimum length of a substring in B containing
all characters of A. [smallcase alphabets]

A = "xyz"
0 1 2

ans = 4

B = "natyxuzmxt y"
0 1 2 3 4 5 6 7 8 9 10 11

A = "abac"
0 1 2 3

ans = 4

B = "b b c a a c b b c b a c a b"
0 1 2 3 4 5 6 7 8 9 10 11 12 13

A = "abab"

ans = 6.

B = "acdmbac aab m z"

idea 1. - Consider all the substrings, for every substring check
if all characters of A are present or not.

$B = \langle x a t y b a x a c t a a b c a \rangle$

ans: 6 9 8 7 6 5 4

$x \rightarrow xz \lambda 0$
 $a \rightarrow xz \beta z \beta \lambda \beta z \lambda z$
 $t \rightarrow x \phi \lambda 0$
 $y \rightarrow x \phi$
 $b \rightarrow x \phi 1$
 $c \rightarrow x \phi 1$

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Or

Dynamic Sliding Window

 $\{A[26], \{B[26];$

```
for (i = 0; i < N; i++) {
    A[A[i] - 1]++;
}
```

$$\text{for } (i = 0; i < N; i++) \{$$

$$\quad \text{for } [B[i] - '0'] ++;$$

$$\}$$
$$\begin{array}{cccc} a & b & c & d \\ 0 & 1 & 2 & 3 \end{array}$$

f_A -

2	1	1		
0	1	2	3	---

 25

$$\begin{aligned} ch - 'a' \\ 'a' - 'a' &\rightarrow 0 \\ 'b' - 'a' &\rightarrow 1 \\ 'c' - 'a' &\rightarrow 2 \\ 'd' - 'a' &\rightarrow 3 \\ &\vdots \\ 'z' - 'a' &\rightarrow 25 \end{aligned}$$

$l=0, r=N-1, ans \rightarrow \infty$

while($r < m$) {

if(compare (fA, fB) == true) {

$ans = \text{Min}(ans, r-l+1);$

$fB[fB[l]-a]--;$

$l++;$

// Releasing character
at l^{th} index.

}

else {

$l++;$

if($r == m$) { break; }

$fB[fB[r]-a]++;$

}

}

return ans;

$T.C \rightarrow O(N+m)$
 $S.C \rightarrow O(1)$

boolean compare(int[] fA, int[] fB) {

for($i=0; i < 26; i++$) {

if($fA[i] > fB[i]$) {
return false;
}

return true;

}

0		0		0
1	0	0	1	0
1	2	3	4	5

4

[4, 1, 4]

✓ 1, 3
 ✓ 1, 3
 → 2, 4
 → 2, 2
 ✓ 1, 1
 → 2, 3
 ✓ 1, 5
 ✓ 1, 5