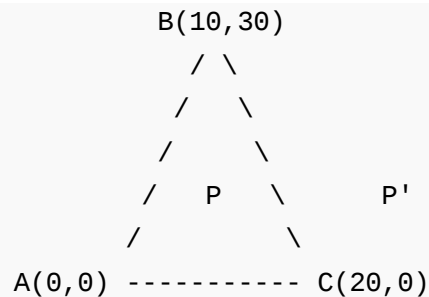


Check whether a given point lies inside a triangle or not

Given three corner points of a triangle, and one more point P. Write a function to check whether P lies within the triangle or not.

For example, consider the following program, the function should return true for P(10, 15) and false for P'(30, 15)



Source: [Microsoft Interview Question](#)

Solution:

Let the coordinates of three corners be (x1, y1), (x2, y2) and (x3, y3). And coordinates of the given point P be (x, y)

- 1) Calculate area of the given triangle, i.e., area of the triangle ABC in the above diagram. Area A = $[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]/2$
- 2) Calculate area of the triangle PAB. We can use the same formula for this. Let this area be A1.
- 3) Calculate area of the triangle PBC. Let this area be A2.
- 4) Calculate area of the triangle PAC. Let this area be A3.
- 5) If P lies inside the triangle, then A1 + A2 + A3 must be equal to A.

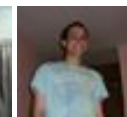
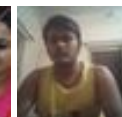
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```
#include <stdio.h>
#include <stdlib.h>

/* A utility function to calculate area of triangle formed by (x1, y1)
(x2, y2) and (x3, y3) */
float area(int x1, int y1, int x2, int y2, int x3, int y3)
{
    return abs((x1*(y2-y3) + x2*(y3-y1)+ x3*(y1-y2))/2.0);
}

/* A function to check whether point P(x, y) lies inside the triangle
by A(x1, y1), B(x2, y2) and C(x3, y3) */
bool isInside(int x1, int y1, int x2, int y2, int x3, int y3, int x, int y)
{
    /* Calculate area of triangle ABC */
    float A = area (x1, y1, x2, y2, x3, y3);

    /* Calculate area of triangle PBC */
    float A1 = area (x, y, x2, y2, x3, y3);

    /* Calculate area of triangle PAC */
    float A2 = area (x1, y1, x, y, x3, y3);

    /* Calculate area of triangle PAB */
    float A3 = area (x1, y1, x2, y2, x, y);

    /* Check if sum of A1, A2 and A3 is same as A */
    return (A == A1 + A2 + A3);
}

/* Driver program to test above function */
int main()
{
    /* Let us check whether the point P(10, 15) lies inside the triangle
    formed by A(0, 0), B(20, 0) and C(10, 30) */
    if (isInside(0, 0, 20, 0, 10, 30, 10, 15))
        printf ("Inside");
    else
        printf ("Not Inside");

    return 0;
}
```

Ouptut:

Inside

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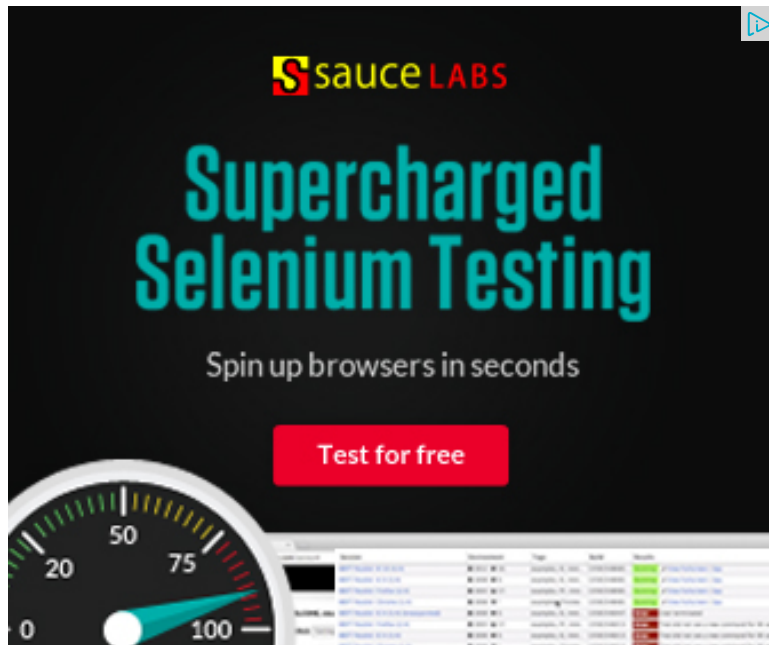
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Exercise: Given coordinates of four corners of a rectangle, and a point P. Write a function to check whether P lies inside the given rectangle or not.

Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above.



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22

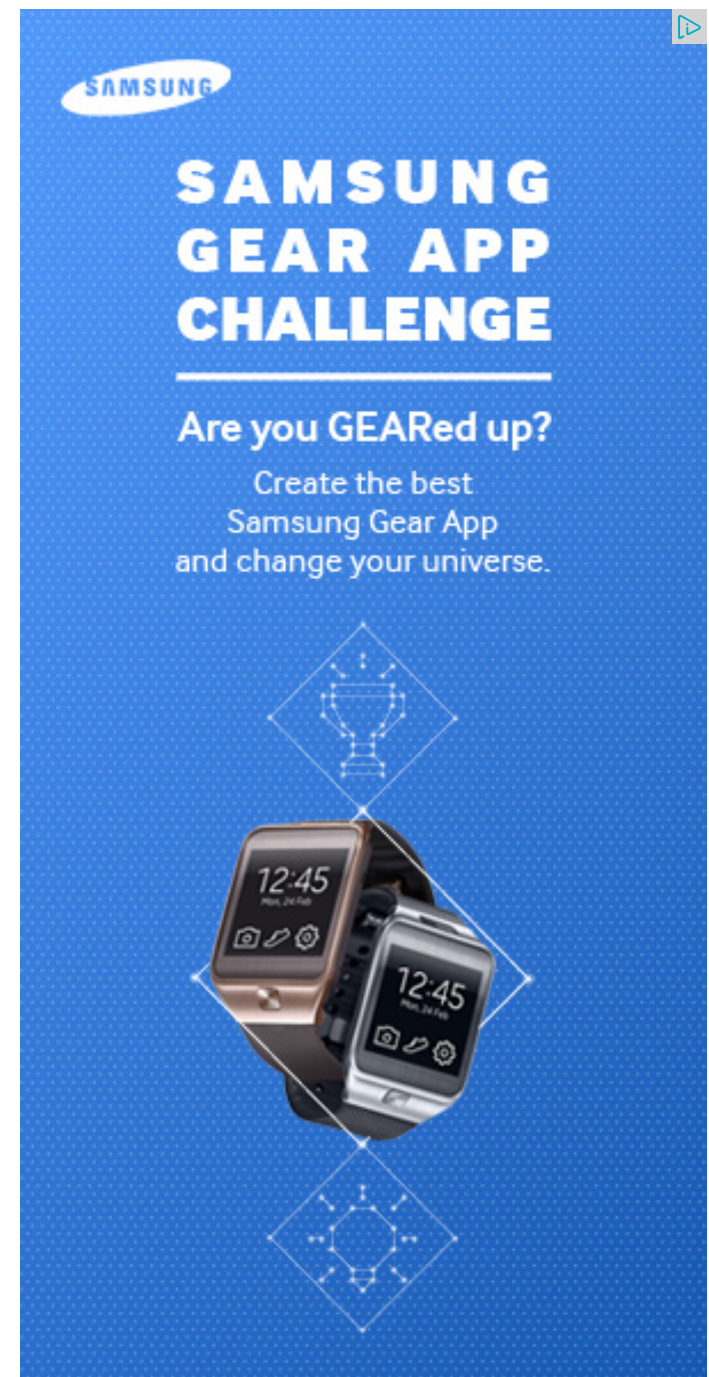


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kkrr · a month ago

its giving "not inside" for the input {0,0 ,2 ,0,1,1} p{1,0} but as the point lie on th "inside"

^ | v ·



Logic · 4 months ago

I wrote a complete article about point in triangle test. It shows the barycentric, methods.

Then it deals with the accuracy problem occuring when a point lies exactly on exposes a complete new method based on point to edge distance.

<http://totologic.blogspot.fr/2...>

Enjoy !

^ | v ·



mbrc · 10 months ago

Will checking for equality of floating numbers work?

^ | v ·



sachin · 2 years ago

Can anybody tell me if a point lies in a n vertices polygon?
How to solve?

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mungruez → sachin · a year ago

I rewrote the code so now it can calculate if the point lies in a triangle w
long.

```

#include<stdio.h>
#include <stdlib.h>
#include <inttypes.h>
/*NAME: Muhammad Zaakir Mungrue PROBLEM: 2153 -Playing with Tri

long double area(int x1, int y1, int x2, int y2, int x3, int y3)
{
    long double X= (x1*(y2-y3) + x2*(y3-y1)+ x3*(y1-y2))/2.0;
    if(X<0)return X*-1;
    return X;
}

int isInside(int x1, int y1, int x2, int y2, int x3, int y3, int x, int y)
{
    long double A = area (x1, y1, x2, y2, x3, y3);
    long double A1 = area (x, y, x2, y2, x3, y3);
    long double A2 = area (x1, y1, x, y, x3, y3);

```

[see more](#)



abhishek08aug → sachin · a year ago

Will the same strategy not work?



vishnu · 2 years ago

```
#include "stdafx.h"
```

```
int maxele=0;
```

AdChoices

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```

int max(int a[])
{
for(int i=0;i<a[i])
continue;
else
maxele=a[i];

}
return maxele;
}

int _tmain(int argc, _TCHAR* argv[])
{
int a[3],b[3],resx,resy;
for(int i=0;i<3;i++)
{
printf("Enter x coordinate of 0/1/2 corner:");

```

[see more](#)



Vishnu [→ vishnu](#) · 11 months ago

This wont work.



duke · 2 years ago

The above problem can also solve by taking the cross product of point to the c sides covering the point which gives the result that the point lies within the edge process for three sides of triangle.

I am pasting my code here.....

```

#include
using namespace std;
typedef struct product

```

```

{
int val[3];
};
product crossproduct(product x,product y)
{
product z;
z.val[0]=x.val[1]*y.val[2]-x.val[2]*y.val[1];
z.val[1]=x.val[2]*y.val[0]-x.val[0]*y.val[2];
z.val[2]=x.val[0]*y.val[1]-x.val[2]*y.val[1];
return z;
}

```

see more

^ | v .



kartik • 2 years ago

@Amandeep Singh & @Hongliang

There should not be any precision problem because we divide integers by 2 and

Also, I think use of floats can be avoided altogether by taking 2 times of areas.

```

#include <stdio.h>
#include <stdlib.h>

/* A utility function to calculate area of triangle formed by (x1, y1)
   (x2, y2) and (x3, y3) */
int area(int x1, int y1, int x2, int y2, int x3, int y3)
{
    return abs((x1*(y2-y3) + x2*(y3-y1)+ x3*(y1-y2)));
}

/* A function to check whether point P(x, y) lies inside the triangle

```


by A(x1, y1), B(x2, y2) and C(x3, y3) */

```
bool isInside(int x1, int y1, int x2, int y2, int x3, int y3, int x, :
```

[see more](#)

1 ^ | v .



Amandeep Singh · 2 years ago

We can actually make equations for three lines and substitute the value of P' in the same side of each line as that of P' will give same sign. this can be used for calculation. Hence no precision problem will occur.

^ | v .



Hongliang · 2 years ago

This solution is good, but it may lead to a precision problem: it introduces float for example area = 100 and the summation of small areas = 99.999 or 100.00 potential pitfalls.

Actually in Quora someone summarized some beautiful answers to all possible <http://www.quora.com/Algorithm...>

P.S. Your problem seems to put an triangle onto a lattice which has integer coordinates one can simply draw a vertical line and check how many (odd for outside, even for inside) intersection points there are. This is a solution without float number calculation.

```
/* Paste your code here (You may delete these lines if not writing code)
```

^ | v .



Hongliang → Hongliang · 2 years ago

Sorry, I meant to: draw a vertical ray (not line) and check how many intersections there are outside. I was typing too fast, sorry.

^ | v .



kafee → Hongliang · 2 years ago

I don't think odd or even will work



rohan agrawal · 2 years ago

@varun

If any one of A_1 , A_2 or $A_3 == 0$, then the point is on the triangle.



Pramod Ganapathi · 2 years ago

A very good concept.

What about this idea?

A triangle is a region formed when three lines intersect each other. Each line is in the form $f(x, y) = 0$. In the new point (a, b) in $f(x, y)$ we may get + or - depending on where the point is relative to the line. We can check the signs of the three functions of the lines $f_1(x, y)$, $f_2(x, y)$ and $f_3(x, y)$ and then check if they are all the same (all positive or all negative) to determine if the point is inside or outside.

I think the idea works but it should be formalized more rigorously.



Varun · 2 years ago

What about when point P is merged with any other point out of A, B, or C.

In this case P doesn't lie inside triangle ABC but still we will get output as true

How this algorithm will take care of this case where P is at Boundary of ABC?

```
/* Paste your code here (You may delete these lines if not writing code)
```





rahul → varun • 2 years ago

Nim Ayyan



Harish → rahul • 2 years ago

just check if the area != 0



```
/* Paste your code here (You may delete these lines if r
```



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