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Lab#1
GNG1106

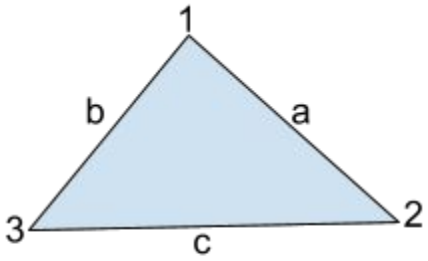
Lab report

STEP 1: Problem Identification and Statement

A program shall be developed that computes the area of a triangle of which the coordinates of its three vertices are given by the user.

STEP 2: Gathering of Information and Input and Output Description

- We wish to compute the area of a triangle. Using the coordinates given by the user, we can calculate the length of each edge of the triangle. Then using the lengths of the edges, we can use Heron's formula to determine the area of the triangle.



$$A = \frac{1}{4}\sqrt{4a^2b^2 - (a^2 + b^2 - c^2)^2}.$$

- Inputs:-coordinates of point 1
  -coordinates of point 2
  -coordinates of point 3

  Outputs: Area of triangle 123

STEP 3: Test Cases and Algorithm Design

- The formula of Heron requires the knowledge of the lengths of all edges of a triangle. Given the coordinates of the vertices, the length of each edge is the magnitude of the vector formed by two vertices: EDGE= $\| \overline{VECTOR} \| = \sqrt{x^2 + y^2}$. Having acquired the lengths of the edges of the triangle, we can now apply formula of Heron $A = \frac{1}{4}\sqrt{4a^2b^2 - (a^2 + b^2 - c^2)^2}.$

- The following table provides a set of test cases that can be used to test the algorithm and software:

Test case	P_1	P_2	P_3	Area (u^2)
1	(0;2)	(1;0)	(1;1)	0.5
2	(3;4)	(1;1)	(-3;4)	9
3	(-5.5;3.4)	(37;61)	(-73;81)	3593

- The following is the algorithm design:

print "Please enter x then y coordinate of the first point"
assign values to x1 and y1
print "Please enter x then y coordinate of the second point"
assign values to x2 and y2
print "Please enter x then y coordinate of the third point"
assign values to x3 and y3

assign $\sqrt{(x2-x1)^2+(y2-y1)^2}$ *to a*
assign $\sqrt{(x3-x1)^2+(y3-y1)^2}$ *to b*
assign $\sqrt{(x3-x2)^2+(y3-y2)^2}$ *to c*
assign $\frac{1}{4}\sqrt{4a^2b^2-(a^2+b^2-c^2)^2}$ *to area*
print "The area of the triangle is "area" "

STEP4: Implementation.

The C program developed is the following:

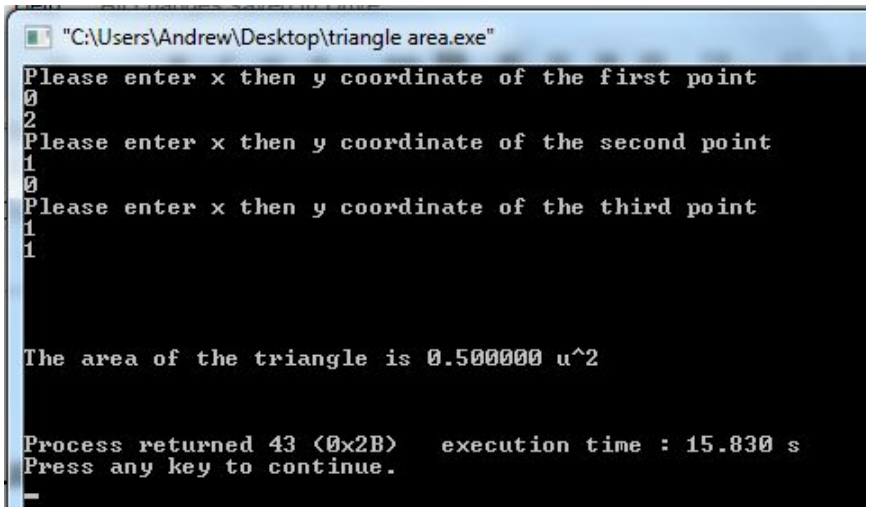
```
/*************************************************************
Name:Andrew Antoun. Student number: 83 88 265
Date: Sept 21, 2015
Program: triangle area.c
Description: This program computes the area of a triangle.
*************************************************************/
#include <stdio.h>
#include <stdlib.h>
#include <math.h>

// main function
int main()
{
   float x1, y1, x2, y2, x3, y3, a, b, c,area;

/*The user must enter the coordinates of
each of the 3 vertices of the triangle.*/
   printf("Please enter x then y coordinate of the first point\n");
     scanf("%f", &x1);
     scanf("%f", &y1);
//x1 & y1 are the coordinates of point 1

   printf("Please enter x then y coordinate of the second point\n");
     scanf("%f", &x2);
     scanf("%f", &y2);
//x2 & y2 are the coordinates of point 2

   printf("Please enter x then y coordinate of the third point\n");
     scanf("%f", &x3);
     scanf("%f", &y3);
//x3 & y3 are the coordinates of point 3
printf("\n\n\n\n");

/*Using the coordinates given by the user,the program will
calculate the length of each edge of the triangle*/
   a = sqrt((x2 - x1)*(x2 - x1)+(y2 - y1)*(y2 - y1)); //a is edge [12]
   b = sqrt((x3 - x1)*(x3 - x1)+(y3 - y1)*(y3 - y1)); //b is edge [13]
   c = sqrt((x3 - x2)*(x3 - x2)+(y3 - y2)*(y3 - y2)); //c is edge [23]
```

```
/*Using the lengths of the edges of the triangle calculated
previously, and by referring to Heron's formula, the program
will  calculate  the  area  of  the  triangle */
  area = 0.25*sqrt((4*a*a*b*b)- pow((a*a+b*b-c*c),2));
    printf("The are of the triangle is %f u^2\n\n\n", area);
}
/*------------------------------END-----------------------------------*/
```

STEP 5: Tests and Verification

- Test case 1: P_1 (0;2); P_2 (1;0) and P_3 (1;1) the output is:

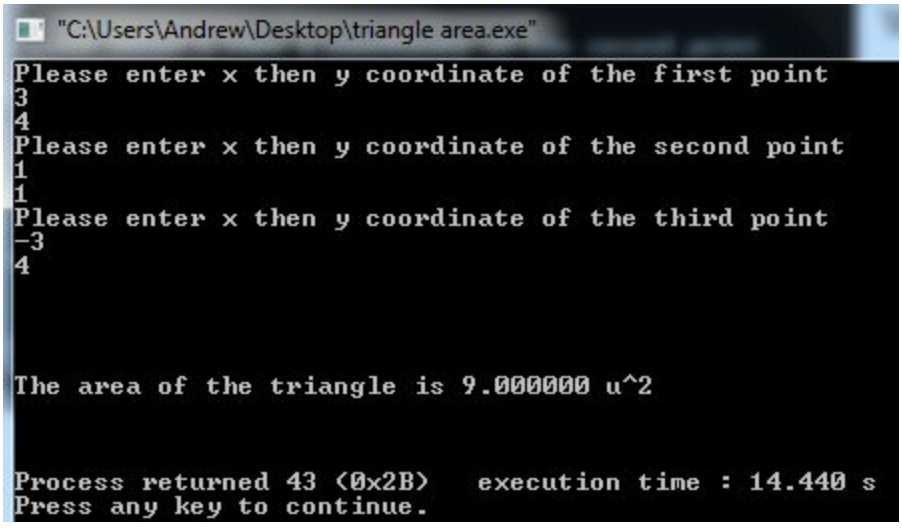
```
The area of the triangle is 0.500000 u^2
```



Which is in agreement with the test case expected output.

- Test case 2: P_1 (3;4); P_2 (1;1) and P_3 (-3;4) the output is:

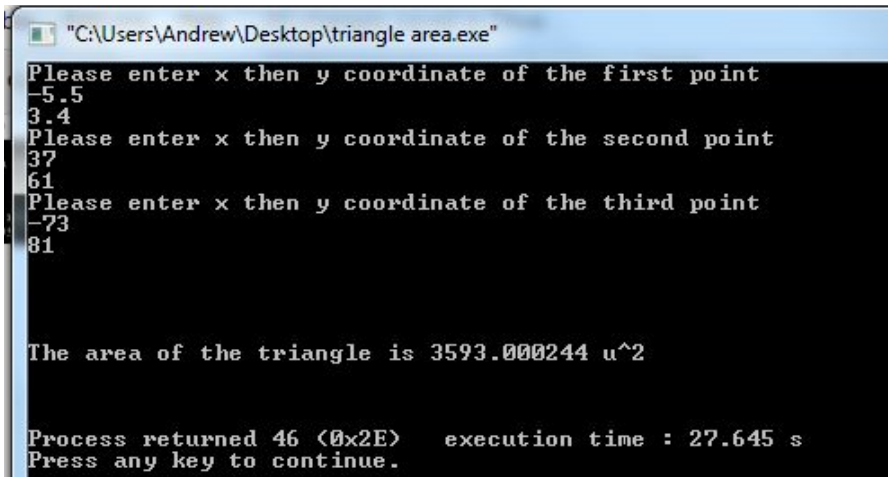
```
The area of the triangle is 9.000000 u^2
```



Which is in agreement with the test case expected output.

- Test case 3: P_1 (-5.5;3.4); P_2 (37;61) and P_3 (-73;81) the output is:

```
The area of the triangle is 3593.000244 u^2
```



Which is in agreement with the test case expected output.

We can conclude that the program is functioning correctly.