CS19001/CS19002 PROGRAMMING AND DATA STRUCTURES LABORATORY
Assignment No: 1
Last Date of Submission: 12–January–2015

Write a C program to perform the following tasks.

1. Let $P = (x_1, y_1)$ and $Q = (x_2, y_2)$ be two points in the two-dimensional plane. For simplicity, assume that P and Q do not lie on a horizontal line, that is, $y_1 \neq y_2$. Read the four coordinates of the points P and Q from the user. These coordinates should be floating-point numbers.

2. Compute and print the distance $d(P, Q)$ between the points P and Q.

3. Compute the equation of the perpendicular bisector L of PQ. Let $y = mx + l$ be the equation of L. The line connecting P and Q has the slope $(y_2 - y_1) / (x_2 - x_1)$. The slope m of L is the negative reciprocal of this (this is defined, since $y_1 \neq y_2$ by our assumption). In order to determine l, notice that L passes through the midpoint of the segment PQ.

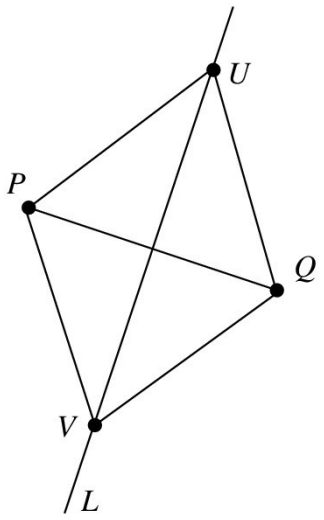
4. Find the two points U and V (on L) such that

   $$d(U, P) = d(U, Q) = d(V, P) = d(V, Q) = d(P, Q)$$

   (see the adjacent figure). Denote the points U and V as (x, y). We have

   $$(x - x_1)^2 + (y - y_1)^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2.$$

   Since U and V lie on L, we also have $y = mx + l$. Substitute this value of y in the last equation to get a quadratic equation in x. Solve the quadratic equation using the standard formula. There are two solutions, corresponding to the two points U and V. Determine their y-coordinates from $y = mx + l$. Print the two points U and V, and also the distances $d(U, P)$, $d(U, Q)$, $d(V, P)$ and $d(V, Q)$.



Submit a single C file solving all the four parts.

Sample Output

```
x1 = 0.916737
y1 = 0.788839
x2 = 0.209986
y2 = 0.019832
P = (0.916737,0.788839), Q = (0.209986,0.019832)
Distance between P and Q is 1.044446
The perpendicular bisector of PQ has equation:
        y = (-0.919044)x + (0.922090).
The first point is U = (1.229340,-0.207729)
Distance between P and U is 1.044446
Distance between Q and U is 1.044446
The second point is V = (-0.102618,1.016400)
Distance between P and V is 1.044446
Distance between Q and V is 1.044446
```

Note: You may make the following math library calls:

```
double sqrt ( double );
double pow ( double, double );
```

In order to use math library calls

```
#include <math.h>
```

and compile with the flag `-lm`.
