

Indian Institute of Technology, Kharagpur

CS19001 Programming and Data Structures Laboratory  
Autumn 2018-19

## Assignment for Week 2 (August 5, 2019)

**Total Marks:** 40

**Duration:** 4 hours

### INSTRUCTIONS

1. Submit a single C file named `[rollno]-week2.c`.
2. You are allowed to consult notes, lectures slides and books.
3. Evaluation will be based on the following criteria: correctness, handling corner cases and programming style.

### PROBLEM

Write a C program that does the following.

1. Let  $A = (x_1, y_1)$  and  $C = (x_2, y_2)$  be two points in the 2-dimensional plane such that  $y_1 \neq y_2$  i.e., the two points do not lie on a horizontal line. Read the coordinates of  $A, C$  from the user as floating point numbers ensuring  $y_1 \neq y_2$ .
2. Print the distance between  $A$  and  $C$ .
3. Compute the midpoint  $X$  of line segment  $AC$ . Let  $y = mx + c$  be the equation of the perpendicular bisector  $\mathcal{L}$  of  $AC$ . Compute  $m$  and  $c$  using knowledge of  $X$ . Print the equation of the perpendicular bisector.
4. Find points  $B, D$  on  $\mathcal{L}$  such that the lengths of  $AB, AD, BC, CD, AC$  are all equal to one another. Let  $(x, y)$  denote the points  $B$  and  $D$ . Given the constraints on distances, we have

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

Since  $(x, y)$  lies on  $\mathcal{L}$  substituting  $y = mx + c$  in the above equation results in a quadratic equation in  $x$ . Solve the equation to find the coordinates of  $B, D$ .

5. Read the coordinates of another point  $P = (w, z)$  and determine whether  $P$  lies inside the parallelogram  $ABCD$ , outside of it or on one of its sides.

You may use the following library functions:

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

To use these write

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

and compile as

```
gcc [filename].c -lm
```