BIL105E - Introduction to Scientific and Engineering Computing
Homework-1

Assignment Date : 25.02.2010
Due Date : 11.03.2010 at 22:00

- Submit two files to Ninova. File names must be your İTÜ student number.
  1) Your C source file (Example: 040090123.c)
  2) Your MS Word report file (Example: 040090123.doc)
- You should use the standard report format (Yazılım Ödevleri Klavuzu) which is available at Ninova.
- Make sure gcc compiles your code successfully on Unix/Linux.
- Cheating is unacceptable and subject to disciplinary actions. All submitted programs will be cross-checked by using an automatic detection system.
- Late submissions through email are not accepted.

IMPORTANT
The following information must be added at the beginning of your C source code, otherwise 10 points will be deducted as penalty from your homework grade.

```
/**************************
Course         : Bil105e
Term           : 2010 Spring
Homework       : #1
Student Name   : Aaa Bbb
Student Number : 123456789
**************************/
```

HOMEWORK DEFINITION

Draw a **Flow Chart** (in your report) and write a **C program** to determine the arrangement status of two lines.

The general equation for a straight line in the cartesian coordinate is Ax+By+C=0.
The arrangement status of two lines can be one of the followings:

- The two lines **"intersect"** with α angle.
- The two lines are **"perpendicular"** with 90 degrees.
- The two lines **"coincide"**. (They lie on the same straight line.)
- The two lines are **"parallel"**.
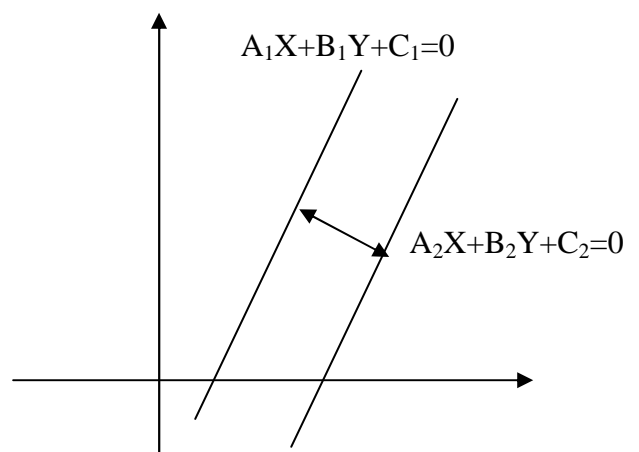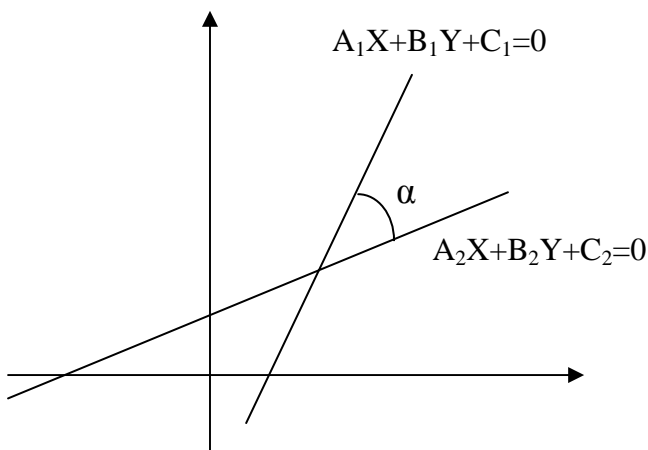
CONDITIONS

Condition for intersection	$\dfrac{A_1}{A_2} \neq \dfrac{B_1}{B_2}$
Condition for perpendicular	$A_1 A_2 + B_1 B_2 = 0$
Condition for parallel	$\dfrac{A_1}{A_2} = \dfrac{B_1}{B_2} \neq \dfrac{C_1}{C_2}$
Condition for coincide	$\dfrac{A_1}{A_2} = \dfrac{B_1}{B_2} = \dfrac{C_1}{C_2}$

EQUATIONS

Equation for angle α between two lines	$Slope = \dfrac{A_1 B_2 - A_2 B_1}{A_1 A_2 + B_1 B_2}$ The angle α is computed by the Arc Tangent equation: $\alpha = \dfrac{\text{atan}(Slope)*180}{3.1416}$
Equations for intersection point (x_0, y_0)	$x_0 = \dfrac{B_1 C_2 - B_2 C_1}{A_1 B_2 - A_2 B_1}$, $\quad y_0 = \dfrac{C_1 A_2 - C_2 A_1}{A_1 B_2 - A_2 B_1}$
Equation for distance between two parallel lines	$d = \dfrac{|C_1 - C_2|}{\sqrt{A_1^2 + B_1^2}}$

INPUTS

The keyboard inputs are the coefficients A_1, B_1, C_1, and A_2, B_2, C_2.

OUTPUTS

- Display a message about the status of the two lines.
- Calculate and display the followings when apply:
    - Angle between the two lines.
    - Intersection point coordinates (x_0, y_0).
    - Distance between the two lines.

SAMPLE TESTING SETS

INPUTS	OUTPUT MESSAGE	EXPECTED OUTPUT VALUES
A1=2, B1=-6, C1=10 A2=4, B2=-12, C2=57	Parallel Lines	Distance : 7.43
A1=1, B1=1, C1=1 A2=2, B2=2, C2=2	Coinside Lines	None
A1=7, B1=-2, C1=14 A2=3, B2=2, C2=-20	Intersection Lines	Alpha = 49.63 Intersection Point : (0.6 , 9.1)
A1=1, B1=-1, C1=20 A2=1, B2=1, C2=-20	Perpendicular Lines	Alpha = 90 Intersection Point : (0.0 , 20.0)

NOTICES

1) Your program should be independent from the sample inputs given above, so we may test your program with different data sets.

2) In this homework, you need to use the following mathematical functions, which are defined in the <math.h> header file.

    atan(x) → Arc tangent of x
    fabs(x) → Absolute value of x
    sqrt(x) → Square root of x