

BLG252E - Object Oriented Programming
Homework-1

Assignment Date : 25.10.2016
Due Date : 15.11.2016 at 18:00

NOTICE

- All member data and functions in a class should be defined as public access.
- A member function body should be written with non-inline syntax, unless it is one line of code.

Write the **Point class** whose members are described below.

Member variables : x, y, z (floats) representing a point in three dimensional coordinate system.

Default constructor : Initializes member variables to zeros.

Parameterized constructor : Initializes member variables with the specified parameter values.

Function whose name is transformation :

- Takes two integer parameters which are the code_of_axis and the rotation_angle.
- The code_of_axis : 1 means around X axis, 2 means around Y axis, 3 means around Z axis.
- The rotation_angle should be in the range of 0 and 360.
- Function performs transformation of the point (x, y, z) and generates a new point (x_{new} , y_{new} , z_{new}).
- Function should return a Point object which contains the transformed new coordinates.
- Procedure of transformation: When an (x,y,z) point is rotated by the angle alpha (α) around a specific axis, a new point is obtained.

Axis of Transformation	Formulae of Transformation
Around X axis	$x_{new} = x$ $y_{new} = y \cos \alpha - z \sin \alpha$ $z_{new} = y \sin \alpha + z \cos \alpha$
Around Y axis	$x_{new} = x \cos \alpha - z \sin \alpha$ $y_{new} = y$ $z_{new} = x \sin \alpha + z \cos \alpha$
Around Z axis	$x_{new} = x \cos \alpha - y \sin \alpha$ $y_{new} = x \sin \alpha + y \cos \alpha$ $z_{new} = z$

Write the following **independent** overloaded operators.

Name of Operator	Type of First Operand	Type of Second Operand	Type of Function Return	Description of Operation
operator -	Constant reference to Point	Constant reference to Point	Point	Subtraction (op1 - op2)
operator -=	Reference to Point	Constant reference to Point	void	Decreasing op1 by op2
operator +	Constant reference to Point	Constant reference to Point	Point	Addition (op1 + op2)
operator +=	Reference to Point	Constant reference to Point	void	Increasing op1 by op2
operator *	float scalar	Constant reference to Point	Point	Multiplication with a scalar
operator *	Constant reference to Point	float scalar	Point	Multiplication with a scalar
operator <<	Reference to ostream	Constant reference to Point	Reference to ostream	Cascaded console output
operator >=	Constant reference to Point	Constant reference to Point	bool	Comparing hypotenuse of two points (op1 >= op2) Hypotenuse = $\sqrt{x^2 + y^2 + z^2}$

MAIN PROGRAM

In the main C++ program, define the following Point objects.

VARIABLE NAME	CONSTRUCTOR PARAMETERS
p1, p5, p6, p7	Default
p2	10, 20, 30
p3	Copy constructor with the p2 object as constructor parameter
p4	2, 6, 17
p8	Copy constructor with the p4 object as constructor parameter

Perform the following operations.

- Subtract p2 from p1, put result in p5.
- Decrease p3 by p4.
- Multiply scalar 3.75 with p2, and add p4 to result, put final result to p6.
- Increase p7 by result of p6+p3.
- Transform p8 around X axis with 45 degrees.
- Transform p8 around Y axis with -30 degrees.
- Transform p8 around Z axis with 60 degrees.
- Print all Point objects (p1 thru p8) on screen.
- Print result of p3+p5 on screen.
- Compare p3+p5 with p4. If greater or equal then display "Condition is true" message, otherwise display the opposite.

EXAMPLE SCREEN OUTPUT

```
p1 = (x,y,z) = 0  0  0
p2 = (x,y,z) = 10  20  30
p3 = (x,y,z) = 8  14  13
p4 = (x,y,z) = 2  6  17
p5 = (x,y,z) = -10 -20 -30
p6 = (x,y,z) = 39.5  81  129.5
p7 = (x,y,z) = 47.5  95  142.5
p8 = (x,y,z) = 9.4657  14.9081  4.14112

p3+p5 = (x,y,z) = -2  -6  -17
Hypothenus p3+p5 >= p4 Condition is true
```

IMPORTANT RULES ABOUT BLG252E HOMEWORKS

1) You must do the homeworks by yourself individually.

- Copying, collaboration, getting help is absolutely not permitted.
- A student should never give his homework to other students.
- All submitted student homework files will be compared by using an automatic detection software system (such as Moss, JPlag, etc).
- If significant amount of similarities are found between any files, it will be considered as cheating; and those homework grades will be zero.

2) You should submit your homework file to Ninova system only.

- Email submissions or late submission requests are not accepted.
- Ninova homework system closes itself automatically at the deadline time.
Therefore you should not wait for homework submission until the last minutes.
- You should submit only a file with *.cpp extension to Ninova.
Other types of files (such as c, txt, docx, zip, rar, etc.) are not accepted.
- If you make any changes in your homework file, you can re-submit it to Ninova within the deadline time.
In that case, only the last submitted file is kept in the system by Ninova.

3) Homeworks will be graded by the course assistant and results will be announced at Ninova.

4) The following criteria will be considered when grading the homeworks.

Your program should ;

- be compilable with all standard compilers (Dev-C++, Linux, etc.) without any syntax errors.
- not include non-portable header files such as <conio.h> , <stdafx.h> , etc.
- work correctly, effectively, and display expected outputs.
- be written according to given specifications.
- have a consistent coding style (indentation, comment lines, valid variable names).
- contain the following information at the beginning of your source file.
(otherwise 5 points will deducted from the homework grade).

```
/******  
Student Number : 123456789  
Student Name   : Aaa Bbb  
Course         : BLG252E  
CRN            : 12345  
Term           : 2016-Fall  
Homework       : #1  
*****/
```