ESC101 : Fundamental of Computing

Lab 7 for 24th September 2008

Hint : The classes for Point, Triangle, Circle are available along with the sample programs on the course website. In this lab exercise, you might like to go through these classes and sample programs.

1. (Marks = 5)

   Design and implement a class LineSegment (using the class Point) with the following attributes and methods.

   Attributes :

   ```
   Point p;
   Point q;
   ```

   These are the end-points of the line segment.

   Note: It may be considered that $p.y \neq q.y$. This is to avoid the condition when the slope of the line segment becomes ∞.

   Constructors :

   - `LineSegment(Point a, Point b)`
     It should build a line segment with end-point p same as that of the Point referenced by `a` and end-point q same as the Point referenced by `b`.
   - `LineSegment(double x1, double y1, double x2, double y2)`
     It should build a line segment with end-point p having coordinates `(x1, y1)` and end-point q having coordinates `(x2, y2)`.
   - `LineSegment()`
     It should build a line segment with end-point p having coordinates `(0, 0)` and end-point q having coordinates `(0, 0)`.

   Methods :

   (a) `public double slope()`
   To determine the slope of the line segment.

   (b) `public boolean isAbove(Point r)`
   Returns *true* if the line obtained by extending *this* line segment lies above point r. Else returns $false$.
   A line l is said to lie above point (α, β) if point $(\alpha, \beta + k)$, for some $k > 0$, lies on the line l. In other words, line $y = mx + c$ lies above point (α, β) if $\beta - m\alpha - c < 0$.

   (c) `public boolean intersects(LineSegment l)`
   To determine whether line segment l intersects with *this* line. Use the method isAbove in this method.

   (d) `public boolean isParallel(LineSegment l)`
   To determine whether line segment l is parallel to *this* line. Use the method slope in this method.

2. (marks = 5)

   Modify the class Triangle which has already been provided in the class notes, to include the following method:

- `public boolean isInside (Point r)`
  to determine if point r lies inside *this* triangle.

  Please observe that a point r lies within a triangle if for each line segment of the triangle, the third point of the triangle and r lie on the same side of the line obtained by extending that line segment. So, you should be using isAbove method of the class LineSegment.

Use this modified Triangle class to develop a program which will take as input the coordinates of the three points of the triangle A, and a point r. (Total eight command line arguments). The program should prints the the following output with suitable messages.

- Area of triangle A.
- Perimeter of triangle A.
- Whether point r lies within triangle A or not.
- Whether line segment passing through $(5, 0)$ and $(0, 5)$ is parallel to any of the sides of triangle A or not.
- Whether line segment passing through points $(0, 0)$ and $(5, 5)$ intersects any of the sides of triangle A or not.