Assignment Set 6

Uploaded on September 23, 2014
Clarification deadline: September 25, 2014
Submission deadline: September 29, 2014
Programming language: Java

1. **Design:** Create a package `cs14xx`. Create subpackages `cs14xx.geometry` and `cs14xx.dsutils` (data structure utilities), where `xx` stands for your roll number, as always.

   Write a class called `Point` under the geometry subpackage, for a point in the two dimensional plane. The class Point should be constructed with its two coordinates, and should have methods `public double getX()`, and `public double getY()`. It should also support the methods `double distanceTo(Point anotherPoint)`.

   Implement a class `ConvexHull` under the geometry subpackage as well. Design yourself how you want to represent a convex hull inside the class.

   Implement a class `Stack` under the dsutils subpackage and implement the usual operations of a stack. This was already done in a class exercise. If you did it right (it is your responsibility to check that) you can reuse it.

   Marks: 10

2. **Computing the convex hull for a set of points [assignment explained in the class]:** Write a static method in the class `ConvexHull` which takes as input a set (in Java, use `Collection<Point>`) of n points $P = \{p_1, p_2, ..., p_n\}$ and computes the convex hull of P by using the Graham's scan algorithm using stack. Check for degenerecy of points. The method should return a `ConvexHull`.

   ```
   public static ConvexHull computeConvexHull(Collection<Point> points)
   ```

   Marks: 45 + 5

3. **Computing the area of the convex hull:** Implement a method `public double area()` in class `ConvexHull` which computes the area of the convex hull.

   Marks: 20

4. **Detecting if a query point is on, inside or outside:** Implement a method `public int findPositionOfPoint(Point point)`, which determines whether a point lies on, outside or inside the convex hull for any input `Point`. If it is on the hull, return 0. Return -1 if it is outside and return 1 if it is inside.

   Marks: 20