Program #2 (4190.410)

Dues: Part I: October 4, 2005
Part II: October 11, 2005
Part III: October 18, 2005

In this programming assignment, you will implement a program that reads two simple polygons as input and compute their union, intersection, and differences as output simple polygons. More specifically, the program should do the following:

1. Read two polygons from the standard input. Each polygon is given in the following format:

   ```
   3
   200 0
   100 100
   0 0
   ```

   This polygon represents a triangle with three vertices of integer coordinates. You may assume that the coordinates are integers in the range of $0 \ldots 1000$.

2. Check if each polygon is simple, i.e., there is no self-intersection.

3. Compute the union of two simple polygons, which can be one simple polygon, a union of multiple simple polygons, or a polygon with many holes.

4. Compute the intersection of two simple polygons, which can be empty, a simple polygon, or a union of multiple simple polygons.

5. Compute the differences of two simple polygons.

In Part I, you have to design the data structure and algorithm of this program. The design should be focus on the simplicity of implementation rather than on the computational efficiency of the algorithm. The algorithm should be explained in great details so that it can easily be implemented as a program. In Part II of this program, we may assume that the input polygons are convex. You have to check whether the two input polygons are convex simple polygons. In Part III, you have to consider the general case.