Math 476: Modern Geometry
Python Handout

Write a Python program to accomplish each task. Each program can use the ones before it. These steps implement the algorithmic proof of the Polygonal Jordan Curve Theorem (Theorem 1.1).

1. Input three points on a line, p_1, p_2, and p_3, and check if p_2 and p_3 are on the same side of p_1. Use the program `xbetween` for guidance.

2. Input four points, p_1, p_2, p_3, and p_4, and check if the ray p_1p_2 intersects the line segment p_3p_4. Use the program `lineintseg` for guidance.

3. Input four points, p_1, p_2, p_3, and p_4, and check if the line segments p_1p_2 and p_3p_4 intersect.

4. Input four points, p_1, p_2, p_3, and p_4, and check if lines p_1p_2 and p_3p_4 are parallel.

5. Input a point p_1 and a polygon P, and output a point p_2 so that p_1p_2 is not parallel to any side of P.

6. Input a ray p_1p_2 and a polygon P, and output the number of vertices of P that p_1p_2 is tangent to (its neighbor vertices are on the same side of p_1p_2).

7. Input a ray p_1p_2 and a polygon P, and output the number of vertices of P that p_1p_2 crosses (its neighbor vertices are on different sides of p_1p_2).

8. Input a point p_1 and a polygon P, and check if the point p_1 is on the boundary of the polygon P.

9. Input a point p_1 and a polygon P, and check if the point p_1 is in the interior of the polygon P. Use the proof of Theorem 1.1 for guidance.