

# Assignment 6: Rendering

15-462 Graphics I  
Spring 2002  
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Out March 21  
**Due March 28 before lecture**  
50 points

- The work must be all your own.
- The assignment is due **before lecture** on Thursday, March 28.
- Be explicit, define your symbols, and explain your steps.  
This will make it a lot easier for us to assign partial credit.

## 1 Intersections (30 pts)

1. Assume you are given two line segments in parametric form:

$$\begin{aligned}\mathbf{p}(\alpha) &= (1 - \alpha)\mathbf{p}_1 + \alpha\mathbf{p}_2, \\ \mathbf{q}(\beta) &= (1 - \beta)\mathbf{q}_1 + \beta\mathbf{q}_2.\end{aligned}$$

Find an algorithm for determining if the two lines intersect.

2. Extend the algorithm from part (1) to determine if two flat, simple polygons intersect.
3. What is the worst-case complexity of your algorithm?
4. Does your algorithm work correctly for flat, non-simple polygons under the odd-even rule to determine their interior? Explain why, or discuss possible adaptations of your method.
5. Suggest at least two efficiency improvements of your algorithm from part (2) and analyze whether they improve the worst-case complexity or just the practical behavior in common cases.

## 2 Compositing (20 pts)

In programming assignment 3 you were asked to generate a shadow by redrawing an object under a projection transformation (see also [Angel, Ch 5.9]).

1. Explain in detail how you might use blending to merely darken the shadow area instead of simply overwriting it with the shadow color. Give the critical calls to OpenGL and sketch where they would be employed.
2. Describe two different methods for obtaining soft shadows. Which one would you prefer for the mobile animation and why?