

**CS 557 F09**  
**Homework #18**  
**Due Thursday, 12 November 2009**

1. How many line segments would be needed to plot the function  $y = \sin(x)$  for  $x \in [0, 1]$  if the distance from the curve to any line segment is not to exceed 0.0001? The  $x$ -coordinates of the endpoints of the line segments are evenly spaced and  $x$  is in radians.
2. A degree 3 Bézier curve has control points

$$\mathbf{P}_0 = (1, 1), \quad \mathbf{P}_1 = (3, 5), \quad \mathbf{P}_2 = (5, 6), \quad \mathbf{P}_3 = (5, 1).$$

How many line segments are needed to plot this curve if the error must be less than 0.001? The endpoints of the line segments are evenly spaced in parameter space.

3. A degree 4 polynomial Bézier curve has control points given in pixel coordinates of:

$$\mathbf{P}_0 = (12, 15), \quad \mathbf{P}_1 = (37, 40), \quad \mathbf{P}_2 = (52, 63), \quad \mathbf{P}_3 = (62, 53), \quad \mathbf{P}_4 = (73, 42).$$

We wish to draw this curve by painting pixels. We decide which pixels to paint by evaluating the curve at  $n$  evenly spaced values of  $t$ . What is the minimum value for  $n$  if we want to be sure that there are no gaps in the curve (that is, every pair of neighboring sample points lie in adjacent pixels or in the same pixel)? (See Chapter 4.1 in the text)