Foundations of Computer Graphics (Fall 2012)

CS 184, Lecture 11: Curves Problems

http://inst.eecs.berkeley.edu/~cs184

To Do

- Making progress on HW 3?
  - Any questions or issues?
- Midterm next week (Oct 11)
  - ***CLOSED BOOK, NOTES, PHONES….***
  - Problems similar to review sessions
  - Covers everything in class (lectures) until Oct 2 lecture
  - See last year's midterm, final on course website

About this session

- Review session for unit on curves
- Go over problems similar to midterm
- (Mostly) done on blackboard; problems PDF online

Motivations
  - Technical issues and problems not fully covered in lecture
  - Chance for you to ask questions in depth (we do have some problems to go over, but it's also question-driven)

Questions?

Problem 1

Consider a uniform quadratic B-spline. Consider a segment with control points (1,0) (1,1) and (0,1) in that order.

- What are the end-points of the curve segment?
- What is the mid-point of the curve segment?

Answer 1

Consider a uniform quadratic B-spline. Consider a segment with control points (1,0) (1,1) and (0,1) in that order.

- What are the end-points of the curve segment?
- What is the mid-point of the curve segment?

Answer: LEFT (1,½) MIDDLE (7/8, 7/8) RIGHT (½,1)

Problem 2

Consider a uniform cubic B-spline. Consider a segment with control points (-1,-1) (-1,1) (1,1) and (1,-1) in that order.

- What are the end-points of the curve segment?
- What is the mid-point of the curve segment?

Answer 2

Consider a uniform cubic B-spline. Consider a segment with control points (-1,-1) (-1,1) (1,1) and (1,-1) in that order.

- What are the end-points of the curve segment?
- What is the mid-point of the curve segment?

Answer: LEFT (-2/3,2/3) MID (0,11/12) RIGHT (2/3,2/3)

Problem 5

Consider the problem of using a Bezier curve to approximate a circle. There exist efficient algorithms to draw Bezier curves, so it is often convenient to reduce other primitives to them. Because of symmetry in a circle, we will consider only the positive quadrant, i.e. with arc endpoints (1,0) and (0,1). What are the control points of a quadratic Bezier curve that best approximates the quarter circle? In particular, the end-points and tangents at those end points of the approximating Bezier curve must match those for the quarter circle. What is the maximum error in this approximation, i.e. the error at the mid-point of the Bezier curve?

Answer 5

Consider the problem of using a Bezier curve to approximate a circle. There exist efficient algorithms to draw Bezier curves, so it is often convenient to reduce other primitives to them. Because of symmetry in a circle, we will consider only the positive quadrant, i.e. with arc endpoints (1,0) and (0,1). What are the control points of a quadratic Bezier curve that best approximates the quarter circle? In particular, the end-points and tangents at those end points of the approximating Bezier curve must match those for the quarter circle. What is the maximum error in this approximation, i.e. the error at the mid-point of the Bezier curve?

Answer: (1,0) (1,1) (0,1) Maximum error is 0.06

Problem 6

Both Bezier and B-spline curves are polynomials. Given any actual curve segment, it can be written as either a Bezier or a B-spline curve of the same degree, but with different control points. First, for a Bezier curve with control points (1,0) (1,1) and (0,1), find the corresponding B-spline control points. Second, for a B-spline curve with control points (1,0) (1,1) and (0,1), find the Bezier control points.

Answer 6

Both Bezier and B-spline curves are polynomials. Given any actual curve segment, it can be written as either a Bezier or a B-spline curve of the same degree, but with different control points. First, for a Bezier curve with control points (1,0) (1,1) and (0,1), find the corresponding B-spline control points. Second, for a B-spline curve with control points (1,0) (1,1) and (0,1), find the Bezier control points.

Answer: Bezier is non-uniform B-spline, or uniform with control points (1,-1),(1,1),(-1,1). Bezier control points are (1/2, 1) (1,1) (1,1/2)