

## HOMEWORK NUMBER TWO

### Curves and Surfaces

Due to Prof. O'Brien Tuesday, October 29th in class.

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1. Algebraically derive the basis functions for quintic (degree five) B-Splines.
  - (a) What sort of continuity will a curve constructed with this basis have?
  - (b) Does this basis have the convex hull property? (Briefly explain why or why not.)
  - (c) Describe at least two reasons why cubic B-Splines might be preferable to quintic.
2. Given a surface described by a tensor-product polynomial basis, how could you accurately compute the tangent plane? How would your answer change if the basis functions were not polynomial? Is there any situation where you would be unable to compute an tangent plane? Explain. (In both the polynomial and non-polynomial case, you may assume that the surface is linear in the control points.)
3. Is there is difference between the class of implicit surfaces that can be described by polynomial and rational-polynomial functions? (Justify your answer.)
4. Write a simple program that reads in a polynomial mesh and performs a finite number of Catmull-Clark subdivisions on it. Include a few screen shots showing your results.
  - (a) For a control mesh with 10 faces, how many levels of subdivision can you do before your program chokes? If you doubled all the resources of your computer (memory, speed, etc.), how many more levels of subdivision could your program deal with? Explain why.
  - (b) Makes some change to the subdivision rules that you thinks will produce interesting results. What is your change? Why did you pick that change? What does it do to your results? Explain why. (Include a few screen shots showing results with your change.)