NAME:
Login name:

Computer Science 426 Exam 1
29 Apr 2003

This test has 8 questions. Do all of your work on these pages, giving the answer in the spaces provided and using the backs of the pages for scratch space. Wherever possible, use concise answers (long, rambling, unfocused answers will be penalized). This is a closed-book exam, but you may use one page of notes with writing on both sides during the exam.

Put your name on every page, and write out and sign the Honor Code pledge before turning in the exam.

``I pledge my honor that I have not violated the Honor Code during this examination."

Question	Score
1	
2	
3	
4	
5	
6	
7	
8	
Total:	(72 possible)

NAME:

Q1: Pipeline

[12 pts] In general, one would expect a red polygon P in the scene to result in some red pixels appearing in the rendered image. State four reasons why this might <u>not</u> occur. For each reason, describe what stage of the conventional rendering pipeline is involved.

(1)

(2)

(3)

(4)

NAME:

Q2: Shading

Flat shading, Gouraud shading, and Phong shading are methods for shading rasterized polygons.

(a) [4 pts] Describe the major difference between Gouraud shading and Phong shading.

(b) [4 pts] Describe a specific situation (or scene) where Gouraud shading and Phong shading produce substantially <u>different</u> results.

(c) [4 pts] Provide two good reasons why one might prefer flat shading to Phong shading.

(1)

(2)

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Q3: Texture mapping

(a) [2 pts] What is the primary purpose of texture mapping?

(b) [2 pts] What is the primary challenge when assigning a texture map to a surface?

(c) [2 pts] State one limitation or visual artifact of using texture mapping.

(d) [2 pts] What is a solid texture?

(e) [2 pts] State an advantage of using a solid texture over conventional texture mapping.

(f) [2 pts] State a disadvantage of using a solid texture over conventional texture mapping.

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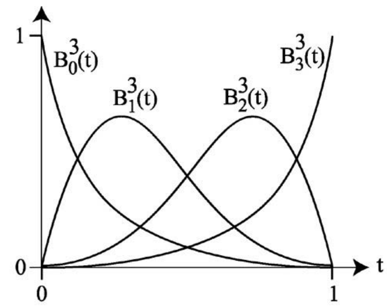
Q4: Curves and Surfaces



(a) [6 pts] Shown above is the graph of the four cubic Bernstein polynomials $B_i^3(t)$, which are the basis functions for cubic Bezier curves. Given four control points $\mathbf{p}_0$, $\mathbf{p}_1$, $\mathbf{p}_2$, and $\mathbf{p}_3$, a Bezier curve C(t) may be computed as a weighted combination of these control points, weighted by the Bernstein polynomials evaluated at parameter t. Briefly explain how you may conclude the following three statements by examining the values in the graph:

Statement 1: Bezier curves interpolate the first and last control points ($\mathbf{p}_0$ and $\mathbf{p}_3$).

Statement 2: Bezier curves do not exhibit local control – the entire curve moves when any of the four control points is moved.

Statement 3: Bezier curves are contained entirely within the convex hull of the control polygon.

(b) [6 pts] For each property below, indicate with a check mark which surface representation possesses that property.

Properties	B-spline surface	Subdivision surface
Permits recursive subdivision		
Is easy to parameterize		
Represents arbitrary topology		
Represents CAT scan data		
Has curvature continuity (C_2)		
Can interpolate the control mesh		

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Q5: Visibility

(a) [4 pts] An *on-line* visible-surface determination algorithm is one that does <u>not</u> need all the geometric data for the scene at the start of processing. Give an example of an *on-line* algorithm. Briefly explain your answer.

(b) [4 pts] Give an example of a visible-surface determination algorithm that is not *on-line*. Briefly explain your answer.

(c) [4 pts] Give an example of a visible-surface determination algorithm that exploits *spatial coherence* within a scene. (It may be the same or different from those in parts *a* and *b*.) Briefly explain your answer.

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Q6: Animation

(a) [6 pts] “Exaggeration” and “secondary action” are two principles of traditional animation. Provide a name and brief description of three more principles of traditional animation.

(1)

(2)

(3)

(b) [4 pts] Give two reasons why it would be a bad idea to use inverse kinematics on a mechanical linkage with 100 segments representing an animated snake.

(1)

(2)

(c) [2 pts] Of the animations that we watched in this class, which was your favorite?

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Q7: Image-based rendering (IBR)

(a) [3 pts] Briefly describe the plenoptic function.

(b) [6 pts] Give two examples of 2D approximations to the plenoptic function used for IBR.

(1)

(2)

(c) [3 pts] Provide one example of a 4D approximation to the plenoptic function used for IBR.

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Q8: 3D Scanning

(a) [4 pts] Give two surface properties that make it difficult to use reflective acquisition methods.

(1)

(2)

(b) [4 pts] State two advantages of "time of flight" methods over "triangulation" methods.

(1)

(2)

(c) [4 pts] State two advantages of "triangulation" methods over "time of flight" methods.

(1)

(2)