CS174A – Introduction to Computer Graphics
MIDTERM STUDY GUIDE

General Instructions

1. Midterm carries 100 points; it will be posted in CCLE, available exactly at 7:10 PM PST
2. Only students registered in the course may take this exam
3. Exam is closed book, closed notes, closed electronics including calculators, only camera on
4. Unless explicitly specified, you don't have to multiply matrices
5. No points are deducted for wrong answers
6. I will NOT ask anything that I've not covered in class
7. Exercises listed below are for reference and practice only, they relate to 8th edition of textbook; all of them may not have 1-to-1 correspondence with material covered in class, treat them as "knowledge gaining" exercises, e.g., 2.15 or 4.26

Chapter 1: Graphics Systems and Models

- What are the 4 elements of computer graphics?
- Examples of procedural animation: physics-based, behavioral
- Difference between random scan (calligraphic) and raster output devices
- Difference between interlaced and non-interlaced devices
- Difference between single and double buffering
- Memory space needed by a frame buffer
- Max time to read pixel from memory at a certain refresh rate
- Exercises 1.8-1.12

Points and Vectors

- Vector operations, properties, inverse, etc. (summary: lecture 3, slide 6)
- Find new point based on initial point and direction of vectors
- Dot products, special cases
- Cross products
- Parametric equations of line and triangle
- What is the diff between affine combinations and convex combination of points?
- Find point on an edge based on different values of α_1 and α_2; which is affine, which is convex?
- Exercise 2.15

Chapter 2.4.1: Polygons

- What is tessellation and triangulation? Difference between them
- Tessellate a 2D closed primitive, like circle or ellipse
- Provide the full index structure of a simple polyhedron
- Two problems with concave polygons: finding outward normals and determining if a point is inside or outside a polygon
- Reasons why triangles are preferred polys in graphics hardware
- Exercises 2.11-2.14, 2.18-2.19

Chapter 4: Transformations

- Properties of affine transformations
- Properties of rigid body transformations
- Translation, scaling, rotation, shear, mirror matrices
- Prove using 2D HMs that scale followed by translation is not the same as translation followed by scaling; in what particular situation will they be same
- Prove using HMs that 2 consecutive transformations are commutative or additive
- How to rotate a point about a random point?
- How to rotate about a random vector, using sequence of rotations or changes of basis/frames?
- Exercises 4.1, 4.2, 4.4, 4.6-4.14, 4.16-4.19, 4.21, 4.26, 4.28, 4.29

Chapter 5: Viewing & HSR

- What params are needed to form eye/camera matrix?
- What params are needed to form parallel or perspective projection matrix?
- Transformations from projection matrices to normalized/canonical forms
- Aspect ratio
- Window to viewport mapping
- All spaces in an end-to-end rendering pipeline, matrices to transform from one space to the next, params to form each of these matrices
- What is back face culling? How do you do this in world space, in eye space and in normalized projection space?
- Exercises: 2.9, 5.1, 5.7, 5.8, 5.17, 12.1, 12.5, 12.6

Geometric Calculations

- Point in polygon test for convex/concave polys: semi-infinite ray, angle summation
- Normal vector calculations: 3 consecutive vertices, summation method
- Plane equations: 3 points in a plane, surface normal + distance from origin
- On-line test
- Edge-edge intersections
- Collinearity test