CS 543 Spring Semester 2018 Exam 2

Name:

Instructions: Read questions carefully before answering. Do not hesitate to ask for clarifications. Show all work. Partial credits are given, so do not leave anything blank! Ask for extra paper if you need it! Good luck!

Question 1: Short Questions (25 points)

a. (5 points) What does the viewport transformation do to z values in 3D vertices?

b. (5 points) OpenGL supports environment maps stored as either _____ maps or _____ maps. (Fill in the blanks)).

c. (5 points) Explain depth compression in the z buffer algorithm.

d. (5 points) What is a scene graph?

e. (5 points) Which of the camera (u,v and n) axes change after a camera roll?

Question 2: (12 points) View Transformation

You are looking at a mesh of a cow that is positioned at origin from the position (x, y, z) with up vector (ux, uy, uz) and have computed your viewing transformation matrix **M** using **lookAt**. You now want to look at the other sides of the cow mesh by simply moving to a new viewing location (e..g –x, -y, -z) but with the same up vector (ux, uy, uz). Can you reuse some elements of the previously calculated viewing matrix **M**? Or would you have to recalculate the matrix M from scratch? If you can reuse M, write out the viewing matrix **M** and circle which elements would CHANGE when you change the viewing position as in the above scenario. If you cannot reuse any elements of the matrix **M**, say why.

Question 3: (14 Points) Lighting and Shading

a. (6 points) Per-vertex lighting interpolates _____

……while per-pixel lighting interpolates _____

b. (4 points) What is the Mach Band effect caused by flat shading

c. (4 points) The Cook Torrance lighting model models real world surfaces as a collection of

_____ (Fill in the blank)

Question 4: (10 points) Projection

Your friend John is modeling his car for the CS 543 project 2. John's car looks nice but when he tries to move his camera closer to get a closer look, he runs into problems. He tries to move the camera position closer to the car but can't seem to get closer. He even tries moving the car and its parts closer and still can't get closer to the car. None of his attempts to get closer to the car seem to be working. Mary who is also in the graphics class walks in and says John is using the wrong type of projection.

Use the information above to answer the following short questions.

i. (5 points) What type of projection is John using that doesn't allow him get a closer look of the car?

ii. (5 points) What is the correct type of projection that John should use if he wants to be able to move closer or further from the car?

Question 5: (5 points) Shadows

Which type of fog model mimics the real world better? Linear fog or exponential fog? Explain

Question 6 (14 points): Texture Mapping

During cube mapping, the reflected vector **R** is calculated as (x,y,z) = (8,6,3). Using **R** to look up the cube map, what face of the cube is looked up? What are the values of *s* and *t* used to perform this look up?

Question 7 (20 points): Backface culling

For a viewpoint located at (10, 10, 10) looking at the origin, indicate which of the triangles defined in OpenGL described in **Table 1** are back facing. Show your work!!

Table 1: Triangle descriptions

Triangle	Vertices	*Back facing (circle one)?*
T_1	(1, 3, 5) (4, 4, 4) (5, 6, 1)	YES NO
T_2	(0, 0, 1) (0, 1, 0) (1, 0, 0)	YES NO