Beijing-Dublin International College

SEMESTER I EXAM EXAMINATION - 2017/2018

School of Computer Science

COMP 3033J Computer Graphics

Prof. Pádraig Cunningham
Asst Prof Abraham Campbell

Time Allowed: 120 minutes

Instructions for Candidates

All questions carry equal marks. The distribution of marks in the right margin shown as a percentage gives an approximate indication of the relative importance of each part of the question.

Answer the 4 Mandatory Questions and 4 Optional Questions

BJUT Student ID: _____ **UCD Student ID:** _____

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I accept the punishment thereof.

Honesty Pledge： _____ **(Signature)**

Instructions for Invigilators

Non-programmable calculators are permitted.
No rough-work paper is to be provided for candidates.

Part 1: Mandatory Questions: Answer all questions

Question 1:

1. What is texture caching and why is it useful?

(4 points)

2. Give three methods to optimize your openGL code?

(3 points)

3. What is the double buffering?

(2 points)

4. What is aliasing and explain two solutions to it.

(3.5 points)

Question 2:

1. What is the difference between Modal and Non-Modal interfaces?

(5 points)

2. Describe with the use of diagram the visual hierarchy of a widget for example that is acting as a printer dialog window?

(4 points)

3. How does an event loop aid in creating a Non-Modal interface? Give an example of an event loop for a computer game to illustrate your point.

(3.5 points)

Question 3:

1. What is the Painters Algorithm and what does it do? When does it break down?

(4.5 points)

2. How is the depth buffer used in projective rendering?

(5 points)

3. Describe the concept of Alberti's Window.

(4 points)

Question 4:

1. What is inverse kinematics and how can simulation support animation in general?

(4 points)

2. How do glPush() and glPop() methods support animation in OpenGL?

(3.5 points)

3. Sketch a suitable animation hierarchy for an Elephant.

(5 points)

Part 2: Optional Questions / Choose 4 out of 6

Question 5:

1. What is XYZ Colour Space?

(3 points)

2. What is the Phong model of Lighting?

(7 points)

3. How and why is surface normal and the eye position used to compute specular reflections?

(2.5 points)

Question 6:

1. What is the difference between C^0 and C^1 continuous line, and sketch an example of a curve that is continuous but not smooth?

(5.5 points)

2. Sketch an example of a curve that is C^∞ .

(2 points)

3. Describe and write pseudocode for the de Castljau algorithm.

(5 points)

Question 7:

1. Describe the six standard coordinate systems that are commonly used in Computer Graphics and name three of the matrices involved.

(6.5 points)

2. Homogeneous coordinates are defined as (x,y,z,w) , if you had a point P at (10,8,16,4) and changed the W component from 4 to 2, what would be the corresponding change to other points if we wanted the point P to still refer to the same point in 3D space.

(3 points)

3. Please write out a 4x4 Homogeneous Matrix, marking where in the matrix, the following operations would act upon.
    a. Perspective operations
    b. Rotational operations
    c. Translational operations

(3 points)

Question 8:

1. Describe and write pseudocode for the generating a smooth cylinder in OpenGL

(6 points)

2. What geometric objects would you use to model a tall skyscraper building at distance and would you use a different set of objects for a model viewed up close.

(3 points)

3. How is the depth buffer used in projective rendering?

(3.5 points)

Question 9

1. Describe Ray Tracing as a technique to generate computer graphics

(5 points)

2. Why can Ray Tracing not be done as efficiently as projective rendering?

(4 points)

3. Why is Raytracing used for Movie CGI while Projective rendering is used for real time computer Graphics?

(3.5 points)

Question 10:

1. Give pseudocode for the Bresenham's Algorithm to draw a line.

(4 points)

2. What is the half-plane test, give a diagram , and explain how it can be used for rendering a triangle?

(3.5 points)

3. Describe how you can interpolate using Barycentric Coordinates using a parametric Algorithm for triangle rendering.

(5 points)