Semester One of Academic Year (2015-2016) of BJUT

《 Computer Graphics》

Module Code: COMP3033J

Exam Paper

Exam Instructions：   Answer 4 Mandatory Questions and 4 Optional Questions

Honesty Pledge：

I have read and clearly understand the Examination Rules of Beijing University of Technology and University College Dublin and am aware of the Punishment for Violating the Rules of Beijing University of Technology and 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 would accept the punishment thereof.

Pledger：   **Class No：**

BJUT Student ID：   **UCD Student ID**

Notes：

The exam paper has 2 parts on 4 pages, with a full score of 100 points. You are required to use the given Examination Book only.

Instructions for Candidates

Full marks will be awarded for complete answer to **All** questions.

Instructions for Invigilators
Candidates are allowed to use non-programmable calculators during this examination.

Obtained score	**Part 1: Mandatory Questions : Answer all questions**

Question 1

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

    (5 points)

2. How can shadows be created using a Ray Tracing technique

    (4 points)

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

    (3.5 points)

Question 2

1. Why do we use CMYK for printing out computer graphics on paper

    (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 3

1. Given Vector u = [4,1,2] and Vector v=[5,4,3], compute a vector perpendicular to both u and v

    (4.5 points)

2. Given Vector u = [3,4] and Vector v =[-8,6], compute the angle between these two vectors

    (4 points)

3. What is the Normalized Vector of Vector w = [3,6,2] ?

    (4 points)

Question 4

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 (5,2,3,1) and changed the W component from 1 to 3, 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)

Obtained score	Part 2: Optional Questions / Choose 4 out of 6

Question 5

1. Why is it important to animate at least higher than 24 frames a second and why does most game engines actual run at 60 frames per second.

(4 points)

2. How does a bone relate to a joint in animation?

(3.5 points)

3. Sketch a suitable animation hierarchy for a Bird

(5 points)

Question 6

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)

Question 7

1. How does a Head Mounted Display allow the user to see stereographic 3D images and why is the Field of View so important for such devices?

(4.5 points)

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

(5 points)

3. In terms of an Augmented Reality display, why is the Alpha channel on an RGBA colour space so important?

(4 points)

Question 8

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

(4 points)

2. What is a Scan-Line interface and why would it increase frame rates?

(3 points)

3. What is the front and back buffer?

(2 points)

4. What is aliasing and what can we do to reduce its impact

(3.5 points)

Question 9

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

(6 points)

Question 10

1. Sketch an example of 1-point perspective

(3 points)

2. What is a vanishing point?

(3 points)

3. Explain foreshortening and its effect on lines

(3 points)

4. Discuss how you would define a View Frustum and sketch an example

(3.5 points)