

## Semester One of Academic Year (Repeat Paper 2016) of BJUT

### 《 Computer Graphics》

Module Code: COMP3033J

### Repeat 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 \_\_\_\_\_

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**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

You should use non-programmable calculators during this examination.

#### Instructions for Invigilators

Candidates are allowed / should use non-programmable calculators during this examination.

Obtained score

**Part 1: Mandatory Questions : Answer all questions****Question 1**

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?  
(3.5 points)
2. How is the depth buffer used in projective rendering?  
(5 points)
3. In terms of an Augmented Reality display, what is the issue when in a well-lit environment like a Sunny day?  
(4 points)

**Question 2**

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 3**

1. Given Vector  $u = [5,6,7]$  and Vector  $v=[1,1,3]$ , compute a vector perpendicular to both  $u$  and  $v$   
(4 points)
2. Given Vector  $u = [10,13]$  and Vector  $v=[1,4]$ , compute the angle between these two vectors  
(4 points)
3. Given a point  $p$  on the surface of a sphere with radius  $r$  and centre  $q$ , what is the normal vector at  $p$  ?  
(4.5 points)

## Question 4

1. Describe the six standard coordinate systems that are commonly used in Computer Graphics **(3 points)**
  
1. Homogeneous coordinates are defined as  $(x,y,z,w)$  , if you had a point P at  $(7,5,3,1)$  and changed the W component from 1 to 2.5 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. **(3.5 points)**
  
2. Please write out examples for 4x4 Homogeneous transformation Matrices performing the following operations ,
  - a. A Rotational operation
  - b. A Shearing operations
  - c. A scaling operations**(6 points)**

Obtained score

**Part 2: Optional Questions / Choose 4 out of 6**

## Question 5

1. How does a bone relate to a joint in animation? **(4 points)**
  
2. How are matrix stacks used in OpenGL to support animation **(3.5 points)**
  
3. Sketch a suitable animation hierarchy for a Horse **(5 points)**

## Question

1. Explain the half-plane test technique to render a triangle . **(5 points)**
  
2. What is the Painters' Algorithm and what does it do? When does it break down? **(4.5 points)**
  
3. Describe the concept of Alberti's Window

(3 points)

## Question 7

1. What is Geometric Modelling?

(3 points)

2. How would you model a Tree at distance and up close. What types of geometric models would you use?

(4 points)

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

(5.5 points)

## Question 8

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

(3 points)

2. Give three methods for optimizing triangle rendering in OpenGL

(4.5 points)

3. What is the frame buffer?

(2 points)

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

(3 points)

## Question 9

1. Sketch an example of 2-point perspective

(3 points)

2. 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

(3 points)

5. Describe and write pseudocode for the de Castljau algorithm

(6.5 points)

## Question 10

1. Why do we use RGB colours in computer graphics

(3 points)

2. 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.

(3 points)

3. How and why is the surface normal used to compute diffuse reflections?

(3.5 points)