



Beijing-Dublin International College



SEMESTER I FINAL EXAMINATION - 2016/2017

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. 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. What is the Tri-stimulus Theory?
(4 points)
3. In terms of an Augmented Reality display, why is the Alpha channel on an RGBA colour space so important?
(4 points)

Question 2:

1. 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)
2. Explain what the follow transformation operations would do in as much detail as you can
 - a.
$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
 - b.
$$\begin{bmatrix} 3 & 3 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
 - c.
$$\begin{bmatrix} 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
(4.5 points)
3. Homogeneous coordinates are defined as (x,y,z,w) , if you had a point P at (21,15,17,1) 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.
(4 points)

Question 3:

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 front and back buffer?
(2 points)
4. What is aliasing and what can we do to reduce its impact
(3.5 points)

Question 4:

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)

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. 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 are matrix stacks used in OpenGL to support animation?
(3.5 points)
3. Sketch a suitable animation hierarchy for a Cat
(5 points)

Question 7:

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 8:

1. Sketch an example of 2-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)

Question 9:

1. Describe Ray Tracing as a technique to generate computer graphics (5 points)
2. Shadows are easy in ray tracing but how can shadows be created in 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. 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)