UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For the following qualifications :-

M.Sc.

ESGV1: Principles of Virtual Environments

COURSE CODE	:	**ENVSGV01**
DATE	:	**08-JAN-02**
TIME	:	**10.00**
TIME ALLOWED	:	**3 hours**

Principles of Virtual Environments
ENVSGVO1

PART A

Candidates must answer ALL the questions from Part A

1. (a) Sarah's avatar is moving through a virtual world. Currently she is at location $\{3,0,-3\}$. What vector would move her avatar to $\{7,0,-8\}$?

(2 marks)

(b) In order to face (0 0 -1), how many degrees should she turn through?

(4 marks)

2.
(a) Construct the 4x4 translation matrix to move Sarah's avatar from $\{3,0,-3\}$ to $\{7,0,-8\}$

(3 marks)

(b) Construct a similar 4x4 rotation matrix to rotate Sarah's avatar by 45 degrees clockwise around the y-axis

(3 marks)

(c) Multiply these matrices together so that Sarah's avatar is first moved and then rotated by 45 degrees.

(4 marks)

(d) Apply this matrix to the point $\{0,0,0\}$, and then again on the result, and then again.

(3 marks)

(e) What route is Sarah's avatar taking when you apply the matrix successively, as you did in part (d)?

(2 marks)

3. (a) The points $\{0,1,3\}$ and $(4,2,4\}$ are two control points. You want to draw a straight line between them using a parametric equation. Demonstrate how the parametric equations:

$x = u^2 x_0 + (u^2 - 1) x_1$
$y = u^2 y_0 + (u^2 - 1) y_1$
$z = u^2 z_0 + (u^2 - 1) z_1$

can be used to describe a straight line path between the two. Include a diagram in your answer with demonstration points on the parametric curve.

(5 marks)

TURN OVER

(b) Briefly describe the purpose of blending functions to draw a curve. What are the two blending functions used in 3(a)?

(4 marks)

(c) With the aid of a diagram, describe the purpose of a "knot vector" for a B-spline curve. For a curve with three control points, what is the difference between applying the knot vector {0,0,0,1,1,1} and {0,1,2,3,4}?

(6 marks)

4. What is a z-buffer used for? Include a diagram in your answer.

(5 marks)

5. (a) Show how to combine the matrices

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{pmatrix} \text{ and } \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \text{ to make a perspective matrix.}$$

(2 marks)

(b) Apply the perspective matrix to the triangle {0,0,-1}, {2,2,-2} and {0,4,-1} and show the distortion produced with the aid of a diagram.

(4 marks)

(c) Do you think this is a good perspective? Give reasons for your answer.

(3 marks)

TOTAL for this section   **50 marks**

PART B

Candidates should refer to the work of authors they have studied wherever relevant and illustrate their answers with examples wherever possible. Candidates should feel free to use diagrams in their answers wherever they feel it is appropriate to do so.

Candidates must answer 2 questions from Part B

1. What is Spatial Audio? How does it enhance virtual environments? What elements are involved and how are they synthesized?

(25 marks)

2.
'The most basic built in rules of virtual places control when you can act, what kind of actions you can take, and who or what you can effect by your actions'
Mitchell, W 'City of Bits' MIT press 1997

What sort of rules are there in Virtual Environments? As a designer what rules do you control and why would you want to control them?

(25 Marks)

3. What is 'Presence' in Virtual Environments? What is the difference between Presence and Immersion?

(25 marks)

4. What is a Distributed Virtual Environment? As designers, how is the design of a distributed office environment related to that of a real building?

(25 marks)

5. How relevant is the role of the Narrative in Virtual Environments? What narrative techniques are applicable in a 3D environment? When would they be used and why?

(25 marks)

6. How can avatars be used for communication in a virtual community? Drawing from your own experience, describe the role of avatars within virtual communities. How did their actions help or hinder communication?

(25 marks)

TOTAL for this section   (50 Marks)

Total for Paper   (100 marks)

END OF PAPER