

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualifications:-

Eng.D. M.Sc.

ESGV1: Principles of Virtual Environments

COURSE CODE : ENVSGV01

DATE : 03-MAY-05

TIME : 10.00

TIME ALLOWED : 3 Hours

ESGV1: PRINCIPLES OF VIRTUAL ENVIRONMENTS (3 hours)

Candidates must answer ALL FOUR questions from PART A and THREE questions from PART B

PART A

Candidates must answer ALL FOUR questions from PART A

1.
 - a) Write TWO computer programs to draw 10 parallel vertical lines on a computer screen in pseudo-code. In one, demonstrate how the function `translate(x,y)`, which translates the current coordinate system by $(x\ y)$, can be used to achieve the result; in the other, demonstrate that the function `translate(x,y)` is not necessary.

In both programs, assume you have a function `line(x,y,a,b)` which draws a line from location $\{x,y\}$ to location $\{x+a,y+b\}$ in the current coordinate system. (4 marks)
 - b) Now write a computer programs to draw a 10 x 10 grid of vertical lines on a computer screen, which demonstrates the use of functions called `translate(x,y)`, `push()` and `pop()`. (4 marks)
 - c) Explain the logic of your placement of the `push()` and `pop()` functions in your solution to part (b). (3 marks)

2. A robot is located on a 2D plane at $\{3,4\}$ and facing in the direction $(0\ 1)$.
 - a) Write down a matrix which will rotate the robot 20° clockwise. (3 marks)
 - b) Apply the matrix to the robot's direction vector $(0\ 1)$. (2 marks)
 - c) Why is a 3x3 matrix required if we would like to translate the robot as well as rotate it? (2 marks)
 - d) Write down a matrix to translate the robot by $(0\ 1)$ from its current location (3 marks)
 - e) Now calculate a matrix which will rotate the robot 20° clockwise before moving it 1 unit in the direction it is facing. (5 marks)
 - f) Transform the robot's location $\{3,4\}$ using the matrix you calculated in part (e). (2 marks)

3. A boid is located at $\{5,5,5\}$ travelling in the direction $(0\ 0\ 1)$. You would like to turn the boid to face the centre of its group, located at $\{8,9,5\}$ using the function '`rotate(x,y,z,angle)`'. Proceed as follows:
 - a) Find the direction vector from the boid $\{5,5,5\}$ to the centre of the group $\{8,9,5\}$. (3 marks)
 - b) Now, find the angle between the boid's current heading $(0\ 0\ 1)$ and the direction to the centre of the group (your answer to part (a)). (3 marks)
 - c) Now, use a cross product to find the axis between the boid's current heading $(0\ 0\ 1)$ and the direction to the centre of the group (your answer to part (a)). (4 marks)

- 4.
- a) Write a program in pseudo-code to draw a parametric representation of the curve $y = x^2$. Assume that you have a function point(x,y) which draws a point at the location {x,y}. (4 marks)
 - b) Describe the purpose of a blending function in a Bezier curve. (5 marks)
 - c) What advantages does a generalized NURBS curve have over a Bezier curve? (5 marks)

Total 52 marks for Part A

PART B

Candidates must answer THREE questions from PART B

- 5. How can presence in virtual environments be measured? Include examples of environments with different levels of presence in your answer. (16 marks)
- 6. How can interactions in virtual space be measured using space syntax? Does this tell us anything about the design of virtual space? (16 marks)
- 7. Explain what spatialised audio is and how it works. (16 marks)
- 8. What is a Collaborative Virtual Environment? What is Augmented Reality? How can both be combined to contribute to the design process? (16 marks)
- 9. How do traditional rules of narrative change when they are applied to virtual environments? (16 marks)
- 10. Describe the factors you need to consider in order to design a good HCI (Human Computer Interaction) experiment. (16 marks)

Total 48 marks for Part B