

UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

Department of Computing

B. Sc. Examination 2019

IS53032C

3D Virtual Environments and Animation

Duration: 2 hours 15 minutes

Date and time:

This paper is in two parts: part A and part B. You should answer ALL questions from part A and TWO questions from part B. Part A carries 40 marks, and each question from part B carries 30 marks. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 100 marks available on this paper.

**THIS PAPER MUST NOT BE REMOVED
FROM THE EXAMINATION ROOM**

Part A
Multiple choice

Question 1

- (a) Which illusion of Virtual Reality is primarily supported by head tracking? [4]
- a) place illusion
 - b) plausibility illusion
 - c) embodiment illusion
 - d) presence illusion
- (b) Which of the following is typically performed in a fragment shader? [4]
- a) transforming vertices
 - b) texturing polygons
 - c) animating objects
 - d) simulating physics
- (c) What is an avatar? [4]
- a) a 3D virtual character that is controlled by computer algorithms and represents a non-player character
 - b) a 3D virtual character that is controlled by and represents a user
 - c) a 3D virtual character whose movements are based on live tracking or motion capture of a users' movements
 - d) all of the above
- (d) What is global illumination? [4]
- a) Simulation of light with a direction but no position, like sunlight
 - b) Simulation of light with a position but no direction, like a lightbulb
 - c) Simulation of lighting bouncing off walls and other objects
 - d) Simulation of lighting performed on whole polygons in a vertex shader
- (e) A classic VR artwork, Osmose by Char Davies, measures users' breath and enables them to fly upwards by breathing in and downwards by breathing out. What type of interaction is this? [4]
- a) Non-deigetic interaction
 - b) Real-world interaction
 - c) Passive Interaction
 - d) Magical Interaction

- (f) Embodiment illusion in VR is primarily achieved using: [4]
- a) Visual-Motor synchrony
 - b) Tactile-Motor Synchrony
 - c) Magical Interaction
 - d) Passive Interaction
- (g) Which of these would be best animated using keyframe animation? [4]
- a) The path of a tennis ball that has been hit by a racquet
 - b) The movement of a tennis racket that is being held by a user
 - c) A children's cartoon character
 - d) The movement of a character that is played by a particular actor
- (h) In modern games a 3D character is typically represented as? [4]
- a) A compound object consisting of several transforms
 - b) A polygon mesh
 - c) A game object
 - d) All of the above
- (i) You are designing a VR simulation for hospital patients that allows them to relax by exploring a large, peaceful garden. Since you are working with patients you are keen to minimise discomfort and disorientation. You have an HTC vive and a room that allows for a 3m by 3m tracking area. Which is the best navigation method for this scenario? [4]
- a) A first-person controller
 - b) Real walking
 - c) Re-directed walking
 - d) Teleportation
- (j) What does a Physic material do? [4]
- a) Controls how an object interacts with other objects
 - b) Controls how an object interacts with lights
 - c) Detects collisions between objects
 - d) Applies forces to objects

Part B

Question 2 Virtual Reality

- (a) What are the three major ways in which Virtual Reality differs from a traditional display technology. Describe each [9]
- (b) Describe two advantages of a high end VR system like an Oculus Rift or VIVE over mobile VR. Explain why they are advantages [6]
- (c) Describe how you designed your VR project so that it supports the three illusions of virtual reality. Evaluate how successful it was [15]

Question 3 Graphics

- (a) Describe how ambient lighting works and its purpose in a traditional graphics pipeline [3]
- (b) Describe four stages of the Virtual Reality Graphics pipeline. For each stage, describe a way in which the graphics processing could be made faster [12]
- (c) Describe the graphics or animation techniques you used in your project. Explain why they were appropriate to the aims of the project [15]

Question 4 3D Interaction

- (a) What is a 6DOF controller? [3]
- (b) A popular interaction in VR is picking up and throwing objects, ideally at other objects or people. Describe the technologies that make this possible, both in terms of the interaction devices and the behaviour of the objects. [12]
- (c) Describe the interaction techniques you used in your project. Explain why they were appropriate to the aims of the project [15]