UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

Department of Computing

B. Sc. Examination 2018

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

Please answer all questions

Question 1   In 1999, Fred Brooks define VR as the experience "in which the user is effectively immersed in a responsive virtual world. This implies..."?

[4]

(a) "using computer generated imagery"

(b) "that the virtual world has to be interactive"

(c) "user dynamic control of viewpoint"

(d) "the use of 3D graphics, 3D interaction, and 3D sound".

Question 2   VR provides a more immersive experience than other media. Which of the following is NOT part of the reason why VR is more immersive than other media?

[4]

(a) User dynamic control of viewpoint

(b) 3D stereo Vision

(c) Surrounding

(d) Display Resolution

Question 3   Which technology would be necessary if we want to do position tracking without using any external camera or sensors?

[4]

(a) We cannot do that

(b) Photogrammetry

(c) Inside-out tracking

(d) Inertial tracking

Question 4   We say system A is more immersive than system B when

[4]

(a) We can simulate A with B

(b) We cannot simulate A with B

(c) We can simulate B with A

(d) We cannot simulate B with A

Question 5   Which statement is true about sensorimotor contingency?

[4]

(a) It means the set of implicit rules by which we use our body to perceive the world with vision

(b) It means the set of explicit rules by which we use our body to perceive the world across all senses

(c) It means the set of implicit rules by which we use our body to perceive the world across all senses

(d) It means the set of explicit rules by which we use our body to perceive the world with vision

Question 6   Which of the following statement is true about illumination?

[4]

(a) Specular shading is cheaper to implement than diffuse shading

(b) We sometimes can use baked shadow to replace global illumination to speed up real-time rendering

(c) We use mainly CPU for illumination

(d) Texture mapping usually happens in vertex shader

Question 7   What is magic interaction?

[4]

(a) Interaction that is possible in VR but not in the real world

(b) Interaction that is not possible in VR or the real world

(c) Interaction that is possible in the real world but not VR

(d) Interaction that is possible both in the real world and VR

Question 8   Room-scale VR can also be called

[4]

(a) World-in-miniature

(b) Teleporting

(c) Real-walking

(d) Walk-in-place

Question 9   What is the correct order of the following tasks when you want to move an object to a new location?
(1) release the button to release the object; (2) press a button to confirm selection; (3) move the object to a new location; (4) move hand in 3D space to the object

[4]

   (a) (1)(2)(3)(4)

   (b) (4)(2)(3)(1)

   (c) (2)(4)(1)(3)

   (d) (2)(4)(3)(1)

Question 10   What is the relationship between an object's graphics mesh and collision mesh?

[4]

   (a) They are the same mesh

   (b) They should be as similar as possible

   (c) The collision mesh normally has more details

   (d) The graphics mesh normally has more details

Part B

Question 11   Graphics and animation

   (a) Objects in 3D graphics are made up of...?   [4]

       i. pixels

      ii. textures

     iii. atoms

     iv. polygons

   (b) How do you create complex shaped objects in real-time 3D graphics (select all that apply)?   [4]

       i. Use a lot of Polygons

      ii. Use very complex polygons

     iii. Use Curved Edges

   (c) There are three basic transformations. Write down their names and give an example of how each can be used.   [6]

   (d) What does a state machine contain?   [6]

   (e) Give an example of where a state machine can be used in animation. Draw the state machine (with at least 3 states).   [10]

Question 12   VR Interaction

(a) Here is some code from the Unity "first person controller" script, which is often attached to the camera:

```
void Update (){
        float xAxis = Input.GetAxis (''Vertical'') * speed;
        float zAxis = Input.GetAxis (''Horizontal'') * speed;
        xAxis *= Time.deltaTime;
        zAxis *= Time.deltaTime;
        transform.Translate (zAxis, 0, xAxis);
        }
```

Briefly explain: what does this code do? Why is it inside the function "Update"?   [6]

(b) If we are going to use the function in VR, what would be the problem and why?   [5]

(c) Explain at least two different ways to fix it (explain the methods, no need to write the code).   [6]

(d) In terms of object interaction in VR, there are different techniques - some represents real world interaction, others go beyond that. Which of the following is true about the Go-go technique (select all that apply)?   [4]

   i. It is a type of hyper-natural interaction

   ii. The virtual arm could grow indefinitely long

   iii. The Go-go technique was invented to help select objects beyond reach in VR

(e) Suppose that in your VR experience you will need the user to select something out of reach. How would you do that? List at least three ways and explain the pros and cons of each.   [9]

Question 13 Virtual Characters and Social VR

(a) Which of the statement is/are true about agents and avatars (select all that apply)? [4]

    i. Avatars are computer algorithm driven

    ii. Avatar can also be called non-player characters

    iii. Agents are computer algorithm driven

    iv. Agents can also be called non-player characters

(b) Write down the basic six emotions invented by Paul Ekman. [6]

(c) Explain the method of Wizard-of-Oz, commonly used with Virtual Characters. Give at least two examples of what type of application where this could be used. [10]

(d) What is Social VR? List at least three possible applications in which social VR could be useful (in different ways) and briefly explain why. [7]

(e) One of the problems with Social VR is that different users might be connected to VR with different VR equipment. Explain why this could be a problem. [3]