UNIVERSITY of STIRLING

Computing Science Examination - Spring Semester 2018

Faculty of Natural Sciences

CSCU9N6: Computer Games Development

Wednesday 25 April 2018 09:00 – 10:30 (1 hour 30 minutes)

This paper contains **FOUR** questions.

Attempt **ALL FOUR** questions (Total marks 50).

Not all questions are worth the same marks.

The distribution of marks among the parts of the question is indicated.

IMPORTANT NOTE

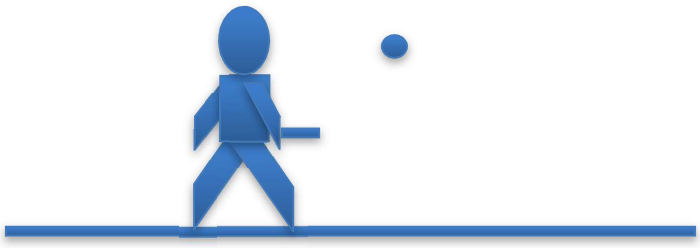
Read the instructions on the front of each answer book carefully.

It is essential that you write your student number on the front of each answer book.

Also, when you have completed the examination, the number of answer books that you have used must be prominently written on the front of one book.

Please do not leave your seat unless you are given permission by an invigilator.

1. You have been tasked with developing an efficient but accurate collision detection system for a 2D game that involves an animated character catching a small ball (see diagram below). The player is able to control the motion of the character, including the angle of the hand relative to the rest of the arm. Provide a description of a collision detection algorithm for this scenario that would ensure it was as efficient as possible while still being reasonably accurate.



[10]

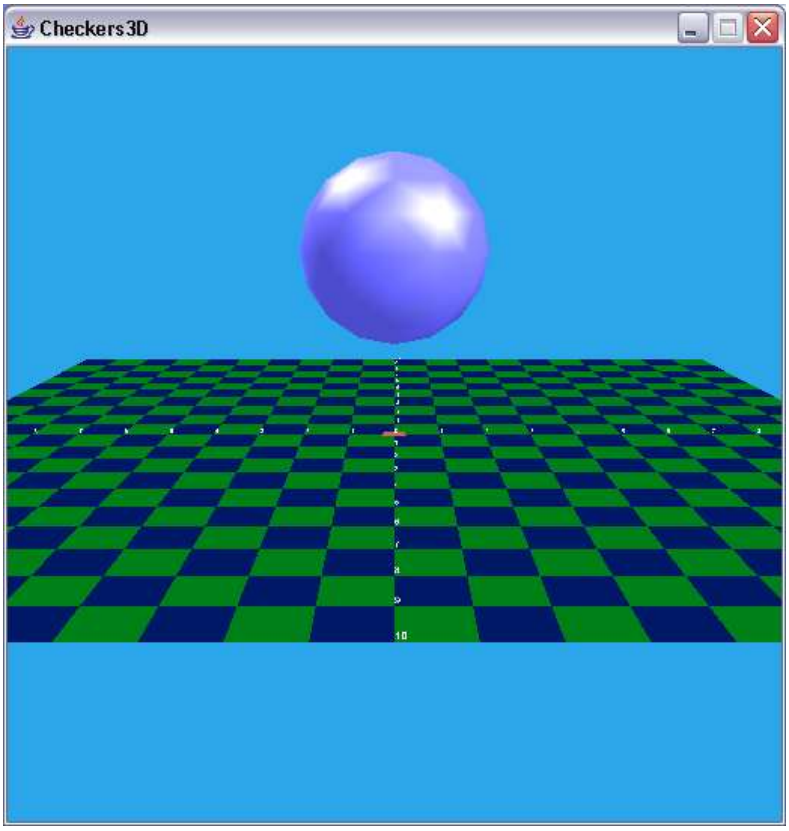
TOTAL MARKS FOR QUESTION 1: **[10]**

2. You are currently developing a 3D game and would like to ensure that you provide an immersive audio experience. Part of this game involves a player character walking down a long hallway with wooden floors and rugs placed on the floor every so often. Given this scenario, describe an effective dynamic approach that you could use to play the sounds of the player's footsteps as they walk down the hall, ensuring that they accurately portray the sounds that would be made if a person were really in such a hallway.

   Note that the path the player takes while walking down the hall will not be predictable in advance and the pace at which they walk will vary from player to player. Describe the advantages and disadvantages of your chosen approach. **[8]**

TOTAL MARKS FOR QUESTION 2: [8]

3. Answer the following questions about this simple 3D scene:



a) What real-world effects are being modelled here to make this scene look realistic and in 3D? **[4]**

b) What effects that you would expect to see are NOT being modelled? Why do you think this is the case? **[4]**

c) Bounding regions are important for the efficient rendering of this scene. Explain how and why at least one bounding region will be in use for this scene. Detail other situations in which a bounding region is likely to be employed and why. **[6]**

TOTAL MARKS FOR QUESTION 3: **[14]**

4. Examine the following Java 3D code fragment that is an incomplete method for creating a simple "person" consisting of cylinders for the body and for the arms, and a sphere for the head. Then answer the following questions.

```
   public TransformGroup createPerson(Vector3f pos) {

   Appearance app = new Appearance();

   // Whole person
   Transform3D transperson = new Transform3D();
   transperson.set(pos);
   TransformGroup tgperson = new
TransformGroup(transperson);

   // Body
   Cylinder body = new Cylinder(0.1f, 0.5f, app);
   Transform3D transbody = new Transform3D();
   transbody.set(new Vector3f(0,0.25f,0));
   TransformGroup tgbody = new TransformGroup(transbody);
   tgbody.addChild(body);
   tgperson.addChild(tgbody);

   // Arms
   Cylinder arms = new Cylinder(0.025f, 0.4f, app);
   Transform3D rotarms = new Transform3D();
   rotarms.rotZ( Math.PI/2.0 );
   TransformGroup tgrotarms = new TransformGroup(rotarms);
   tgrotarms.addChild(arms);

   // Head
   Sphere head = new Sphere(0.2f, app);

   return tgperson;
   } // end of createPerson method
```

Continued/

a) Write lines of code that will complete construction of the "person" so that it will look something like this:

This will involve code to move the arms and head into suitable positions, relative to the body. Remember that when creating a geometric primitive, such as a cylinder, it is created symmetrically around the point (0,0,0). For example, (0,0,0) is the centre of a sphere. Cylinders are by default vertical, so a rotation of 90 degrees has been provided to make the cylindrical "arms" horizontal along the x-axis.

You just need to write down the lines that you will add, in the order they would be added, without rewriting the entire method. **[6]**

b) Draw the scene graph branch corresponding to this code starting from the top level "tgperson" node. Label each node in your scene graph with the variable name corresponding to it from the code. **[6]**

c) How could you use textures to improve the appearance of this "person"? Describe any issues or difficulties involved here. **[6]**

TOTAL MARKS FOR QUESTION 4: **[18]**

END OF EXAMINATION PAPER