

THE AUSTRALIAN NATIONAL UNIVERSITY
Final Examinations (Semester 2) 2011

COMP4610/COMP6461
(Computer Graphics)
Final Exam - Sample

Writing Period: 3 hours duration

Study Period: 15 minutes duration

- you may read text files and pdfs but you are not permitted to start answering questions.

Permitted Materials: A4 page (one sheet) with notes on both sides

Note the standard lab tools are available including: Java, eclipse, ooffice, kate, dia, gcc, ... Also your home directory contains an OpenGL command summary.

Please Read The Following Instructions Carefully.

This exam will be marked out of 100 and consists of 4 questions. Questions are of unequal value. The value of each question is shown in square brackets. Questions that are partitioned into parts show the number of marks given to each part within square brackets.

Students should attempt all questions. Answers must be saved into the question's directory(Q1, Q2, Q3, Q4) using the file(s) described in the question statement. Marks may be lost for giving information that is irrelevant.

Network traffic may be monitored for inappropriate communications between students, or attempts to gain access to the Internet.

Question 1 - Short Answer [40 marks]

Highest marks are gained by providing: clear, concise, and short answers. Save your answers in the file 'Q1Answers.odt' in the directory Q1. This file can be edited using 'ooffice'. Please make certain that this file is saved both as you progress through the exam and before the exam ends.

- i. [4 marks] Contrast the context in which the RGB and CMY colour models are used(i.e. When would you use RGB? When would you use CMY). Provide a formula that would map colours from RGB to CMY.
- ii. [4 marks] Explain how pixels are normally organised in the contiguous memory of the frame buffer. State how a screen co-ordinate could be translated into an address of the frame buffer.
- iii. [4 marks] State the distinction between Hermite and Cardinal Splines. Contrast their advantages/disadvantages.
- iv. [4 marks] What are homogeneous coordinates? Why are they so useful in Computer Graphics? Show the form of the translation matrix (assume 2D space).
- v. [4 marks] Provide an example of temporal aliasing. Give two approaches that could be used to help address this problem.
- vi. [4 marks] Explain how matrix (3D, using homogeneous coordinates) can be used to achieve a perspective projection. Illustrate this with an example.
- vii. [4 marks] Explain how the 'reverse painters algorithm' works. What is the main advantage of this approach over the 'painters algorithm'.
- viii. [4 marks] How would the differences between: flat, Gouraud, and Phong shading be visually evident within an image.
- ix. [4 marks] One simple way of producing shadow effects is to draw the object in 'black' under a transformation that projects the object onto the plane. Explain the framework and steps involved in calculating such a transformation matrix. (You do not need to derive the matrix just state the steps involved in deriving it.)
- x. [4 marks] Does ray tracing produce shadows from reflected/refracted sources of light? Explain

Question 2 Lab [15 marks]

Using either `ScreenSaverOGL.java` or `ScreenSaverOGL.c` which forms a simple screen saver program. These files can be found in the Q2 directory. Copy and rename one of these files into your answer file, called `SimplePoly.java` (or `SimplePoly.c`) which is also saved in the Q2 directory.

Create a simple polygon that rotates in 3D on it's y-axis.

Duplicate this polygon 4 times so that the same polygon is rotating simultaneously in 4 different places on the screen. In doing this you should use either a method for drawing the shape which you call 4 times or by using a display list (i.e. `glNewList`, `glEndList`, and `glCallList`). This will also involve using `glPushMatrix` and `glPopMatrix`.

Add a comment in your answer file which gives the commands used to compile and run your code, also in this comment add a very brief summary of what you did.

Question 3 Lab [15 marks]

Make a simple object (something a little more complex than a sphere or a cube, examples include: a pencil, cup, light post, mobile phone, etc...) in Blender. Add lighting and set up some type material with a texture. Render your object into a jpeg. Save both the jpeg along with the blender file (.blend) in the Q3 directory. Also include in this directory a README file which includes a short description of what you attempted to produce in this question. Also save this README file in the Q3 directory.

Question 4 Lab [30 marks]

Note part marks in these questions may be gained for: partial working solutions; or just a viable description of how you would approach such a problem. Please copy code as needed from either the Q2 and Q3 directories. Do only **ONE** of the following two options:

A. Using Blender to make a fireworks display. There should be two types of fireworks:

- one that produces a fountain of sparkles,
- one that is launched with a rocket(which has a fire tail) and explodes into a colourful pattern at the top.

Create an animation which has a number of fireworks going off over 10sec and save it using a "jpeg avi" format in the Q4 directory. Also save the blender file along with a plain text README file in the Q4 directory. The README file should contain a short summary of what you did.

B. Using OpenGL create a 3D robotic crane that has 3 degrees of freedom in its movement. The crane should also be able to grab a single cube which is within the scene. Enable the user to move the crane using keyboard input, also the user can grab and move the box within the scene. Save your code in the Q4 directory. Also save a short set of instructions within a README file in the Q4 directory. Below is an image just to give you an idea of what is expected. Your scene does not need to exactly follow this example.

