MONASH University
Information Technology

FIT3088
Computer graphics

Unit Guide

Semester 1, 2011

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FIT3088 Computer graphics - Semester 1, 2011

Computer graphics is concerned with the creation of synthetic images and virtual worlds. This unit introduces the essential algorithms, theory and programming concepts necessary to generate interactive 2D and 3D graphics. Students will gain practical experience using the industry standard OpenGL API to develop their own interactive graphics applications. The topics covered form the basis of core knowledge necessary for developing applications in scientific visualisation, virtual reality, visual special effects and computer games.

Mode of Delivery

Clayton (Day)

Contact Hours

2 hrs lectures/wk, 2 hrs laboratories/fortnight

Workload

For on campus students, workload commitments are:

- two-hours of lectures each week, and
- two-hour laboratory class each fortnight
- a minimum of 4-5 hours of personal study per one hour of contact time in order to satisfy the reading and assignment expectations.
- You will need to allocate up to 5 hours per week in some weeks, for use of a computer and assignment work.

Unit Relationships

Prohibitions

CSE3313, DGS3622, FIT3005, GCO3817

Prerequisites

FIT2004 or CSE2304

Chief Examiner

Peter Tischer

Campus Lecturer

Clayton

Marc Cheong

Learning Objectives

At the completion of this unit students will have -
A knowledge and understanding of:

- mathematical representations of basic geometric primitives in Euclidean space, such as points, lines, polygons and parametric curves;
- how to use homogeneous co-ordinates and transformations on geometric objects in two and three dimensions.
- how to combine multiple transformations efficiently;
- orthographic, parallel and perspective projections and their related homogeneous transformations;
- appropriate data structures for hierarchical representation of polygonal datasets;
- rasterisation algorithms for drawing in frame buffers;
- the use of Quaternions to represent object rotation;
- a synthetic camera model for viewing and projecting of two and three-dimensional geometry;
- algorithms for hidden surface removal and backface elimination. The capacity to analyse the space and time complexity of these algorithms to determine the most appropriate in a given situation;
- BRDF Shading models such as Lambert, Phong, Blinns Phong, Torrance-Sparrow-Blinn-Cook-Beckmann, Oren-Nayar;
- textures and texture mapping;
- basic knowledge of aliasing theory;
- interpolative shading models. Shadow algorithms. Local and global illumination models;
- the OpenGL state-machine, GPUs and graphics pipline.

Developed attitudes that enable them to:

- understand the role and value of visual communication in the arts and sciences;
- appreciate the uses and application of interactive, real-time graphics and software rendering.

Developed the skills to:

- program basic interactive graphics applications in OpenGL;
- apply computer graphics theory and algorithms to the design of visual computing applications.

Graduate Attributes

Monash prepares its graduates to be:

1. responsible and effective global citizens who:

a. engage in an internationalised world
b. exhibit cross-cultural competence
c. demonstrate ethical values

critical and creative scholars who:

a. produce innovative solutions to problems
b. apply research skills to a range of challenges
c. communicate perceptively and effectively

Assessment Summary

Examination (3 hours): 70%; In-semester assessment: 30%

Assessment Task	Value	Due Date
Assignment 1: 2D Graphics	10%	Week 6, Friday 8 April 2011
Assignment 2: 3D Graphics	20%	Week 12, Friday 27 May 2011
Examination 1	70%	To be advised

Teaching Approach

Lecture and tutorials or problem classes

This teaching and learning approach provides facilitated learning, practical exploration and peer learning.

Feedback

Our feedback to You

Types of feedback you can expect to receive in this unit are:

- Informal feedback on progress in labs/tutes
- Graded assignments with comments

Your feedback to Us

Monash is committed to excellence in education and regularly seeks feedback from students, employers and staff. One of the key formal ways students have to provide feedback is through SETU, Student Evaluation of Teacher and Unit. The University's student evaluation policy requires that every unit is evaluated each year. Students are strongly encouraged to complete the surveys. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

For more information on Monash's educational strategy, and on student evaluations, see:
http://www.monash.edu.au/about/monash-directions/directions.html
http://www.policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html

Previous Student Evaluations of this unit

If you wish to view how previous students rated this unit, please go to
https://emuapps.monash.edu.au/unitevaluations/index.jsp

Required Resources

Processing: available at <http://www.processing.org>

Jogl (Java OpenGL) available from <http://java.net>

The Java Development Kit (JDK) available from <http://www.java.com>

Any machine with OpenGL or MESA installed (see: <http://www.opengl.org>).

Unit Schedule

Week	Date*	Activities	Assessment
0	21/02/11	Orientation week: No formal assessment or activities are undertaken	No formal assessment or activities are undertaken in week 0
1	28/02/11	Course Overview, Introduction, History	
2	07/03/11	Displays, 2D Graphics with Processing	
3	14/03/11	2D Transforms, Homogeneous Transforms	
4	21/03/11	OpenGL I, OpenGL II	
5	28/03/11	OpenGL III, 3D Graphics Introduction	
6	04/04/11	3D Transforms, Compound Transforms	Assignment 1 due Week 6, Friday 8 April 2011
7	11/04/11	Perspective, OpenGL Viewing	
8	18/04/11	3D Viewing, Hidden Surface Removal I	
Mid semester break			
9	02/05/11	Hidden Surface Removal II, Lighting	
10	09/05/11	Texturing, OpenGL Compositing/Animation	
11	16/05/11	Phong Shading, Global Illumination	
12	23/05/11	Developments in CG Research, Exam Revision	Assignment 2 due Week 12, Friday 27 May 2011
	30/05/11	SWOT VAC	No formal assessment is undertaken in SWOT VAC

*Please note that these dates may only apply to Australian campuses of Monash University. Off-shore students need to check the dates with their unit leader.

Assessment Policy

To pass a unit which includes an examination as part of the assessment a student must obtain:

- 40% or more in the unit's examination, and
- 40% or more in the unit's total non-examination assessment, and

- an overall unit mark of 50% or more.

If a student does not achieve 40% or more in the unit examination or the unit non-examination total assessment, and the total mark for the unit is greater than 50% then a mark of no greater than 49-N will be recorded for the unit

Assessment Tasks

Participation

- **Assessment task 1**

Title:
Assignment 1: 2D Graphics
Description:
Programming assignment 1: 2D graphics with Processing
Weighting:
10%
Criteria for assessment:
Adherence to the specification; quality of programming: robustness, efficiency, correctness; correct implementation of required and optional features; adequate documentation; Creativity and innovation of solution; Quality of graphics code.
Due date:
Week 6, Friday 8 April 2011

- **Assessment task 2**

Title:
Assignment 2: 3D Graphics
Description:
Programming assignment 2: 3D graphics with OpenGL
Weighting:
20%
Criteria for assessment:
Adherence to the specification; quality of programming: robustness, efficiency, correctness; correct implementation of required and optional features; adequate documentation; Creativity and innovation of solution; Quality of graphics code.
Due date:
Week 12, Friday 27 May 2011

Examinations

- **Examination 1**

Weighting:
70%
Length:
3 hours
Type (open/closed book):
Closed book
Electronic devices allowed in the exam:
None

Assignment submission

Assignment coversheets are available via "Student Forms" on the Faculty website:
http://www.infotech.monash.edu.au/resources/student/forms/
You MUST submit a completed coversheet with all assignments, ensuring that the plagiarism declaration section is signed.

Extensions and penalties

Submission must be made by the due date otherwise penalties will be enforced.

You must negotiate any extensions formally with your campus unit leader via the in-semester special consideration process:
http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html.

Returning assignments

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later

Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at:
http://policy.monash.edu.au/policy-bank/academic/education/index.html

Key educational policies include:

- Plagiarism (http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-policy.html)
- Assessment (http://www.policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-po
- Special Consideration (http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.h
- Grading Scale (http://www.policy.monash.edu/policy-bank/academic/education/assessment/grading-scale-policy.html)
- Discipline: Student Policy (http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-discipline-policy.html)
- Academic Calendar and Semesters (http://www.monash.edu.au/students/key-dates/);
- Orientation and Transition (http://www.infotech.monash.edu.au/resources/student/orientation/); and
- Academic and Administrative Complaints and Grievances Policy (http://www.policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy.

Student services

The University provides many different kinds of support services for you. Contact your tutor if you need advice and see the range of services available at www.monash.edu.au/students The Monash University Library provides a range of services and resources that enable you to save time and be more effective in your learning and research. Go to http://www.lib.monash.edu.au or the library tab in my.monash portal

for more information. Students who have a disability or medical condition are welcome to contact the Disability Liaison Unit to discuss academic support services. Disability Liaison Officers (DLOs) visit all Victorian campuses on a regular basis

- Website: http://adm.monash.edu/sss/equity-diversity/disability-liaison/index.html;
- Telephone: 03 9905 5704 to book an appointment with a DLO;
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1 Gallery Building (Building 55), Monash University, Clayton Campus.

Highly Recommended

Slater, Mel et. al.: Computer Graphics and Virtual Environments: from realism to real-time, Addison Wesley, 2002.

Hearn, Donald and M. Pauline Baker: Computer Graphics with OpenGL (3rd International Edition), Pearson Prentice Hall, 2004

Angel, Edward: OpenGL: A Primer, (2nd Edition) Addison Wesley, 2004.

Supplementary Reading

Van Verth, James M. and Lars M. Bishop: Essential Mathematics for Games and Interactive Applications, A Programmers Guide, Morgan Kaufmann, 2004.

Shreiner, D. et. al.: OpenGL Programming Guide (5th Edition), The Official Guide to Learning OpenGL, Version , Addison Wesley 2006.

Angel, Edward: Interactive Computer Graphics: A top-down approach using OpenGL (Third Edition), Addison Wesley, 2003.

Hill, F.S. Jr.: Computer Graphics Using Open GL (2nd Edition), Prentice-Hall, 2001.