MONASH University
Information Technology

FIT3088
Computer graphics

Unit Guide

Semester 2, 2010

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Table of Contents

FIT3088 Computer graphics - Semester 2, 2010

Chief Examiner:

Ben Porter

Lecturer(s) / Leader(s):

Clayton

Ben Porter

Introduction

Welcome to FIT3088 Computer Graphics. This course aims to give a general introduction to two and three-dimensional computer graphics. Computer graphics techniques play a major a role in computing and many other disciplines. Applications include such diverse areas as graphical user interfaces (GUIs), photorealistic simulation in the film and television industries, scientific visualisation, medical simulation, Geographic Information Systems (GIS), Virtual Reality (VR), interactive multimedia and computer games. In addition to these many applications, computer graphics has a strong foundation in computer science. This course has an emphasis on theory, with reference to the practical applications of algorithms and techniques. Successful completion of the course should give you a solid background in the basics of modern computer graphics topics, such as synthetic camera models, graphics programming languages, hidden surface removal and shading algorithms. This knowledge can be applied to engineer simple graphics applications and serves as a basis to more advanced study in graphics at honours and postgraduate level.

Unit synopsis

This unit deals with techniques for generating lines, curves and surfaces. The unit covers graphics devices, graphics software, line, arc and curve drawing, clipping, scan conversion and overlapping regions, 2D and 3D transformations, shading and hidden surface algorithms, synthetic camera models, real-time interaction and computer animation.

Learning outcomes

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: 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 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 C/C++ and OpenGL;
- apply computer graphics theory and algorithms to the design of visual computing applications.

Contact hours

2 hrs lectures/wk, 2 hrs optional 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 inorder to satisfy the reading and assignment expectations.
- You will need to allocate up to 5 hours per week in some weeks, for use ofa computer and assignment work.

Unit relationships

Prerequisites

FIT2004 or CSE2304

Prohibitions

CSE3313, DGS3622, FIT3005, GCO3817

Teaching and learning method

Teaching approach

Lectures (2 hours per week), Practical Assignments (2), Lab classes (every second week), Consultation.

Timetable information

For information on timetabling for on-campus classes please refer to MUTTS,
http://mutts.monash.edu.au/MUTTS/

Tutorial allocation

On-campus students should register for tutorials/laboratories using the Allocate+ system:
http://allocate.its.monash.edu.au/

Unit Schedule

Week	Date*	Topic	Key dates
1	19/07/10	Course Overview, Introduction, History	
2	26/07/10	Displays, 2D Graphics with Processing	
3	02/08/10	Text, Curves and Simple Transformations	
4	09/08/10	Affine transforms, Compound Transforms	
5	16/08/10	Introduction to OpenGL	
6	23/08/10	3D transforms and primitives	Assignment 1 Due
7	30/08/10	Synthetic Camera Models, Projections	
8	06/09/10	Animation and Interactivity	
9	13/09/10	Backface elimination, Hidden surface removal	
10	20/09/10	Shading and illumination models	
Mid semester break			
11	04/10/10	Interpolative shading models	
12	11/10/10	Global illumination: ray tracing and radiosity	Assignment 2 Due
13	18/10/10	Revision	

*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.

Improvements to this unit

A Monquest evaluation will be run for this unit.

Unit Resources

Prescribed text(s) and readings

Recommended text(s) and readings

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.

Required software and/or hardware

Processing: available at www.processing.org

Jogl (Java OpenGL) available from java.net

Any machine with OpenGL or MESA installed (see: www.opengl.org).

Equipment and consumables required or provided

Students studying off-campus are required to have the minimum system configuration specified by the Faculty as a condition of accepting admission, and regular Internet access. On-campus students, and those studying at supported study locations may use the facilities available in the computing labs. Information about computer use for students is available from the ITS Student Resource Guide in the Monash University Handbook. You will need to allocate up to **n** hours per week for use of a computer, including time for newsgroups/discussion groups.

Study resources

Study resources we will provide for your study are:

- Weekly detailed lecture notes;

- Tutorials every second week of semester, beginning week 3
- Assignment specifications and sample solutions;
- A sample examination;
- Discussion groups;
- This Unit Guide outlining the administrative information for the unit;
- The unit web site on MUSO, where resources outlined above will be made available.

Assessment

Overview

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

Faculty 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.

Assignment tasks

Assignment coversheets

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.

Assignment submission and return procedures, and assessment criteria will be specified with each assignment.

Assignment submission and preparation requirements will be detailed in each assignment specification. 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.

- **Assignment task 1**

  Title:
  Assignment 1
  Description:
  Programming assignment 1: 2D graphics
  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:
  Friday, 27 August 2010

- **Assignment task 2**

  Title:
  Assignment 2: 3D Graphics
  Description:
  Programming assignment 2: 3D graphics
  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:
  Friday, 15 October 2010

Examination

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

See Appendix for End of semester special consideration / deferred exams process.

Due dates and extensions

Please make every effort to submit work by the due dates. It is your responsibility to structure your study program around assignment deadlines, family, work and other commitments. Factors such as normal work pressures, vacations, etc. are not regarded as appropriate reasons for granting extensions. Students are advised to NOT assume that granting of an extension is a matter of course.

Students requesting an extension for any assessment during semester (eg. Assignments, tests or presentations) are required to submit a Special Consideration application form (in-semester exam/assessment task), along with original copies of supporting documentation, directly to their lecturer within two working days before the assessment submission deadline. Lecturers will provide specific outcomes directly to students via email within 2 working days. The lecturer reserves the right to refuse late applications.

A copy of the email or other written communication of an extension must be attached to the assignment submission.

Refer to the Faculty Special consideration webpage or further details and to access application forms: http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html

Late assignment

Assignments received after the due date will be subject to a penalty of 1 mark per day, including weekends. Assignments received later than one week (seven days) after the due date will not normally be accepted. In some cases, this period may be shorter if there is a need to release sample solutions.

This policy is strict because comments orguidance will be given on assignments as they are returned, and samplesolutions may also be published and distributed, after assignment marking or with the returned assignment.

Return dates

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

Feedback

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

Informal feedback on progress in labs/tutes

Graded assignments with comments

Appendix

Please visit the following URL: http://www.infotech.monash.edu.au/units/appendix.html for further information about:

- Continuous improvement
- Unit evaluations
- Communication, participation and feedback
- Library access
- Monash University Studies Online (MUSO)
- Plagiarism, cheating and collusion
- Register of counselling about plagiarism
- Non-discriminatory language
- Students with disability
- End of semester special consideration / deferred exams