UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
SCHOOL OF COMPUTER SCIENCE & APPLIED MATHEMATICS

COMS3006A: Computer Graphics and Visualisation

Course Outline

Semester 1, 2022

1 Instructor

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Consultations: https://calendly.com/kleinric/cgv

2 The Course

Topics

The course seeks to expose the learner to the field and provide an introductory foundation to computer graphics and rendering. Computer graphics is the term commonly used to describe computer generation and manipulation of images. Its uses include cartoons, film special effects, video games, medical imaging, engineering, as well as scientific, information, and knowledge visualization. The area encompassed by Graphics and Visualization is divided into several interrelated fields:

Fundamentals: Computer graphics depends on an understanding of how humans use vision to perceive information and how information can be rendered on a display device. Every computer scientist should have some understanding of where and how graphics can be appropriately applied as well as the fundamental processes involved in display rendering.

Modeling: Information to be displayed must be encoded in computer memory in some form, often in the form of a mathematical specification of shape and form.

Rendering: Rendering is the process of displaying the information contained in a model.

Animation: Animation is when the rendering is done in a manner that makes images appear to move and the synthesis or acquisition of the time variations of models.

Visualization: The field of visualization seeks to determine and present underlying correlated structures and relationships in data sets from a wide variety of application areas. The prime objective of the presentation should be to communicate the information in a dataset so as to enhance understanding

Computational Geometry: Computational Geometry is the study of algorithms that are stated in terms of geometry.

Prerequisites

It is useful if you have knowledge or are in a position to acquire knowledge of some of the following:

C++ or C: Some of the OpenGL will be done in this;

Javascript: WebGL will require this; and

Calculus and Linear Algebra: Solving equations, derivatives, integrals; vectors, matrices, basis, solving systems of equations.

3 Teaching Methods

The course will be presented in person unless there is a change caused by the pandemic. This course will consist of

- weekly in-person lectures;
- lecture videos posted to Moodle and YouTube;
- weekly in-person lab sessions; and
- readings from the prescribed textbook.

Contact times are as follows:

Format	**When**		**Venue**
Labs	Tuesday	14:15 – 17:00	MS Labs
Lectures	Friday	10:15 – 12:00	WSS2

Attendance and Submissions

All material presented during in-person lectures is examinable. Submissions for at least 80% of the assignments/labs/tests and a class average above 35% is required to qualify to write the final exam. See UG Computer Science outline for information on FNQL.

4 Assessments and Grading

Based on the evolution of the pandemic this mark breakdown is subject to change.

If an in-person exam *is* possible:

Lab Assignments	10%
Project Beta	10%
Tests	20%
Exam	60% (40% Theory; 20% Project)

Course Schedule

Students are requested to review the work schedule below, paying particular attention to the dates of the assessment opportunities. Please note that the schedule pertaining to the material covered is tentative and subject to change. Lab time is shared with COMS3007A (Machine Learning). It is up to you to manage your time responsibly.

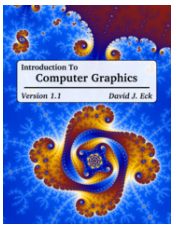
Week	Date	Format	Subjects / Readings
01	01 Mar		
	04 Mar	Vid 0a	Introduction, 2D Graphics (Ch 1, 2.1–2.3)
02	08 Mar	Lab 1	2D Transforms
	11 Mar	Vid 0b	Hierarchical Modelling (Ch 2.4, 2.6, 2.7)
03	15 Mar	Lab 2	2D Graphics with HTML Canvas
	18 Mar	Vid 1a	OpenGL 1.1 Shapes & Transforms. (Ch 3.1–3.2, 3.6, A.2)
04	22 Mar	Lab 3	Hierarchical Modelling
	25 Mar	Vid 1b	OpenGL 1.1 Projection & Viewing. (Ch 3.3, 3.4, 3.6.)
05	29 Mar	Lab 4	Introducing OpenGL 1.1
	01 Apr	Vid 2a, 2b	OpenGL Light and Material. (Ch 4.1–4.2)
06	05 Apr	**Test 1**	**Test written via Moodle in MSL (Ch 2 & 3)**
	05 Apr	Lab 5	Light and Material in OpenGL 1.1
	08 Apr	Vid 2c, 2d	Textures; More on Scene Graphs. (Ch 4.3–4.4)
07	12 Apr	Self-Study	Three.js + (Lab 9 + Lab 10 Optional) (Ch 5.1–5.3)
Mid-Term Vacation (15 April – 20 April)			
08	19 Apr	**Project**	**Project Alpha, No Mark**
	22 Apr	Vid 3a	Introducing WebGL (Ch 6.1)
09	26 Apr	Lab 6	WebGL Intro
	29 Apr	Vid 3b	GLSL; 2D Graphics with WebGL. (Ch 6.2–6.3)
10	03 May	Project	Project Work
	06 May	Vid 3c	WebGL Textures (Ch 6.4)
11	10 May	**Project**	**Project Beta (Graded)**
	13 May	Vid 4a	3D Transformations (Ch 7.1)
12	17 May	**Test 2**	**Test written via Moodle in MSL (Ch 4 & 6)**
	20 May	Vid 4b	WebGL Lighting & Material, Shaders (Ch 7.2)
13	24 May	Lab	Project work
	27 May	Vid 4c	WebGL Shaders (Ch 7.3–7.4)
14	31 May	**Project**	**Final Project Demonstrations**
			Recorded Videos, Deployment to LAMP, Demo to tutors
14	31 May		Beyond Rasterisation: ray tracing, path tracing & AI. (Ch 8)
15	07 Jun	**Project**	**Final Project Demonstrations**
Exam			

Academic Integrity

Refer to the General Undergraduate Computer Science outline for the school's policy on plagiarism.

4.1 Textbook

The textbook for this course is available for free online. You may also purchase a copy if you wish online[1].



Title:	Introduction to Computer Graphics
Edition:	1.3, August 2021
Author:	David J. Eck
Publisher:	David J. Eck (Creative Commons Attribution 2.0)
ISBN-13:	NA
Web Site:	http://math.hws.edu/graphicsbook/

5 e-Learning Resources

You are encouraged to use Google, YouTube, OpenCourseWare, StackOverflow, OpenCourseWare and any other online resources. Links to online resources will be provided via Moodle when relevant, but you are encouraged to find your own as well.

6 Other Notes

1. The purpose of the laboratories is for you to get hands-on experience with the theory that has been discussed in classes.
2. You will work on these small programming problems during the laboratory sessions and you may ask the teaching assistants for help.
3. You should not expect sample solutions of worksheets and projects to be handed out. If you cannot solve a programming problem on your own, then please ask for help and it will gladly be given.
4. All tests/exams will be closed-book unless specified otherwise.
5. If you have queries regarding the marking of your test script, you must write a short paragraph to submit with your script for remarking, that describes why you believe that a specific question deserves more marks. If I've made a mistake adding this is not necessary, just bring the script to me.

[1] http://www.lulu.com/shop/david-eck/introduction-to-computer-graphics/paperback/product-22543170.html