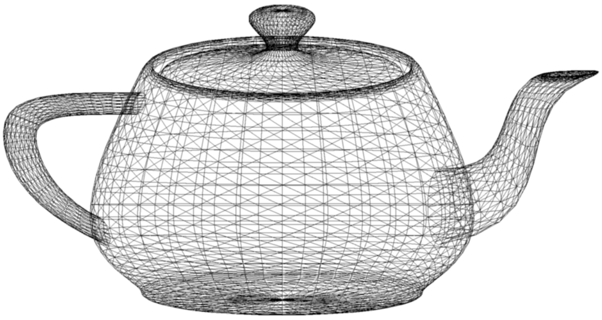
Advanced Computer Graphics

CM30075

Coursework Specification 2020-2021



(a)

(b)

(a) Simple Wireframe Teapot, Ken Cameron
(b) Utah Tepot Rendering Competition Winner, Laura Marie Lediaev
Figure 1

Introduction

This unit is assessed 100% by coursework. There is no written examination. The coursework comes in three stages.

1. Four lab exercises. These are smaller mostly self-contained tasks with near weekly deadlines. Most students should be able to achieve full marks on these with support from the tutors.
2. The main rendering project split into three parts.
    a. The first step beyond the labs.
    b. Photon mapping, a more advanced rendering approach.
    c. A free choice of another rendering feature if intermediate complexity.

    The majority of students should be able to complete tasks a. and c. within the time allowed. Not all students are expected to fully complete b.

3. A final rendered image. Marks are also available for a good quality image produced by the software you create.

There are multiple deadlines to help ensure you make steady progress over the semester. This document is the full coursework specification and you are free to begin tasks ahead of earlier deadlines.

Stages

1. Labs

    30% of the overall marks are awarded for the four mini-assignments that require you to build basic rendering programs.

    Lab 1 Rasterising Lines 5%

    Build the program using main_lab1.cpp, replacing the line drawing function in linedrawer.cpp with an integer based one.

    Lab 2 Reading Models 5%

Build the program using main_lab2.cpp, filling in the missing code in polymesh.cpp in order to read a 3D object files. This will allow you to generate a rasterised, wireframe image of the model.

Lab 3   Simple Raytracing   10%

Create a new main program that performs raycasting to render the teapot. Use the framebuffer code to write out the depth buffer image to check that it is functioning correctly. You will be allocated 5% for the raycasting structure and 5% for triangle intersection. If you do not have the triangle intersection working, you can still get the structure 5% by using the supplied sphere intersection test.

Lab 4   Basic Lighting   10%

Extend the program you developed in Lab 3 to perform local lighting. This includes ambient, diffuse and specular lighting (5%) and shadows (5%).

2. Project and Report.

   After completing the mini-assignments you should begin work on the main project and report. This is worth 60% of the overall unit mark. This stage of the coursework requires you to have working versions of the lab 3 and 4 code. After the deadline for those labs, a sample solution will be released, and you will be free to use this without penalty.

   In this part of the coursework you will extend the basic raytracer to add more advanced features. These include,

   1. Reflection and Refraction. 10%

   2. Photon-mapping. 40%

   3. One additional feature of you own choice. For example: CSG, Textures, Procedural Geometry or Shading, Depth of Field. 10%

3. Final Image.

   10% of the unit mark is allocated for the production of a final image. The image should be a minimum resolution of 512x512 pixels and make use of the teapot dataset. You should use the code you submitted for Stage 2, you should not add new functionality but can fix any bugs you discover during this period. If the code or data used for the final image has been modified from that submitted in Stage 2, a copy of the modified version should be submitted as part of this Moodle Assignment.

Marking Guide

Submissions using only the basic raytracer developed in the labs, but with a good quality report and high quality image may be able to achieve a borderline pass overall. Submissions that extend the basic raytracer to support reflection, refraction, and/or an additional extension of your choice can achieve a mark in the **3nd class** range with a good quality report. Submissions that additionally support photon mapping of diffuse reflections can achieve a mark in the **2nd class** range with a good quality report. Submissions additionally supporting more complete photon mapping can achieve a mark in the **1nd class** range with a good quality report, with transmitted caustics needed to be in the highest part of the range.

Good quality code will:

a. Make use of sensible names for functions, classes, variables, etc.

b. Have a sensible structure that is efficient where appropriate.

c. Make use of comments to assist the reader to follow the functionality.

d. Clearly indicate any code that is not your own and cite the source.

e. Work.

A good quality report will provide:

a. A clear explanation of the objective of the code.

b. A brief, clear description of the theory/methods/algorithms employed.

c. An overview of the code developed, including any design decisions taken, problems encountered and how these were overcome.

d. Appropriate diagrams/illustrations/renderings to assist the readers understanding.

e. Appropriate references to any literature that has been relied on.

Good quality images will:

a. Consist of a scene that is of sufficient complexity to demonstrate the key features of the raytracer.

b. Avoid artefacts that detract from the image such as excessive noise or low-resolution.

c. Show some level of artistic merit in the composition.

d. Make use of the teapot dataset.

Submission

Stage 1

For each lab, you should submit your code and a sample image for each 5% task claimed. Images should be between 128x128 and 512x512 in size and in PNG format. Your code should be uploaded as a ZIP file. The uploaded images should NOT be included in the zip file.

Stage 2

On completion you are expected to submit the following:

1. The code you have developed.

2. A report of 4 to 6 pages that explains the theory behind the code you have created.

3. To demonstrate the functionality of your code, you should include an appendix of illustrative images in your report and referenced them in the main text. This must not include any diagrams as those should be part of the main text. This will not form part of the report page count.

You must upload this to the Moodle Assignment. Your report must be in PDF format and uploaded as a stand-alone uncompressed file. You should upload your code and any data it requires as a single separate zip file. The uploaded report should NOT be included in the zip file.

Stage 3

You should also upload your final example image in PNG format. If you have made any changes to the code/data, from that uploaded to the Stage 2 Assignment, you must upload a fresh zip file. As in previous years, the images will be used to create a class gallery. Please upload a .txt file that contains your name as you wish it to appear in any attribution and a title for the image. You may also indicate if you do not wish the image to appear in the gallery.

Deadlines

All work must be uploaded to Moodle by the following deadlines.

Stage 1 Lab 1	Code + Image	8pm Friday 9th October 2020	Week 2
Stage 1 Lab 2	Code + Image	8pm Friday 16 8th October 2020	Week 3
Stage 1 Lab 3	Code + Images	8pm Friday 30st October 2020	Week 5
Stage 1 Lab 4	Code+ Images	8pm Friday 6th November 2020	Week 6
Stage 2	Code + Report	8pm Friday 4th December 2020	Week 10
Stage 3	Image Title [Code]	8pm Friday 11th December 2020	Week 11

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