

This session will begin shortly

# Computer Graphics Exam Briefing

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# The Problem

Writing "fair" exams is HARD even in "normal" times  
In the current situation it is VERY challenging

We need to accurately assess individuals' ability...  
Key to this is preventing collusion !

This unit is very practical - not well suited to exam !  
(but we need to fit into the programme structure)

# Practicalities of online exams

Everyone has access to workbooks/books/internet  
So we CAN'T assess recall of facts  
e.g. "Name three types of light used in rendering"

Everyone has access to maths tools and libraries  
So we CAN'T assess mathematical ability  
e.g. "Perform Matrix and Vector operations"

This isn't a "learn how to code" unit  
So we don't want to be assessing programming skills  
e.g. "Implement a rasteriser"

# What CAN we examine then ?

We need to assess YOUR skills and abilities

Things that YOU know how to do (from experience)

Things YOU'VE learnt (from doing the workbooks)

Which operators to apply in a given situation

How to perform key rendering techniques

Emphasis on SINGLE points/pixels/surfaces

(rather than entire screens or complex models)

# Nature of Exam

Exam will be a FULL 2 hours of work !

(not the usual "finished in half the time" type thing)

Need to keep people busy to stop them "straying"

Exam written assuming people will use digital tools

Matlab, Mathematica, Wolfram, C++, Java, Python !

If choose to do everything with pen and paper...

You'd better be fast - or you won't finish in time !

# Nature of Exam

Exam will take place online via Blackboard  
Fill in the text boxes (plus upload PDF of workings)

There will 10 questions worth 20 marks in total  
Each question will be worth 1, 2 or 3 points

Each question will be selected randomly from a pool  
(so that everyone gets a slightly different exam)

# Focus of Exam

The exam will focus on the 7 "core" workbooks (i.e. it won't include "08 Advanced Topics Playlist")

Exam questions tend to suggest themselves !  
equally...

Some topics are clearly unsuited to exam context

Let us consider the "Ray Tracing" workbook:

<https://github.com/drslock/CG2021>



# Past Paper Questions

# Colour Interpolation

There are two points A and B on a 1D linear colour spectrum, as shown in the diagram below:



The x position of A is 92 and it has an RGB colour of [90, 90, 213]

The x position of B is 479 and it has an RGB colour of [180, 204, 22]

What is the colour at x position 340, providing your answer in the form of separate Red, Green and Blue colour channels integers (0-255) each rounded to the nearest whole number.

# Projection onto the Image Plane

Given the following situation:

- a vertex in 3D space at position  $[22, -29, 31]$
- a camera positioned at  $[0, 0, 160]$  and oriented towards the world origin
- a focal length of 80
- an image plane of size  $160 \times 120$  (width x height)

Calculate the  $[x,y]$  coordinates on the image plane at which the vertex should be drawn. Assume an SDL style image plane (i.e. origin at the top left corner) with no image plane scaling in use. Providing your answer rounded to the nearest 2 decimal places.

# Camera Orientation

The following is a camera orientation matrix (with elements rounded to 2 decimal places), where the first column is *right* the second column is *up* and the third column is *forward* aspects of the camera:

$$\begin{bmatrix} 0.67 & -0.02 & 0.75 \\ -0.0 & -1.01 & -0.02 \\ 0.75 & 0.01 & -0.67 \end{bmatrix}$$

What is the camera orientation matrix after a rotation of 44 degrees in the y axis, about the centre of the camera ?

Navigation icons: back, forward, search, etc.

# Reflection

Consider a 3D model containing a single triangle with vertices:  
[-446, -209, -102] [441, -152, -116] [-22, 404, -87]

A single light point is positioned at [11, -4, -18]

Assuming that the surface of the triangle is a perfect mirror:

Give the normalised reflection vector of light bouncing off a point on the surface at [-76, 0, -101] rounding your answer to the nearest two decimal places.

# Specular Lighting

Consider a 3D model containing a single triangle with vertices:  
[-446, -209, -102] [441, -152, -116] [-22, 404, -87]

A single light point is positioned at [11, -4, -18]

Assuming that the surface of the triangle is a perfect mirror:

Give the normalised reflection vector of light bouncing off a point on the surface at [-76, 0, -101] rounding your answer to the nearest two decimal places.

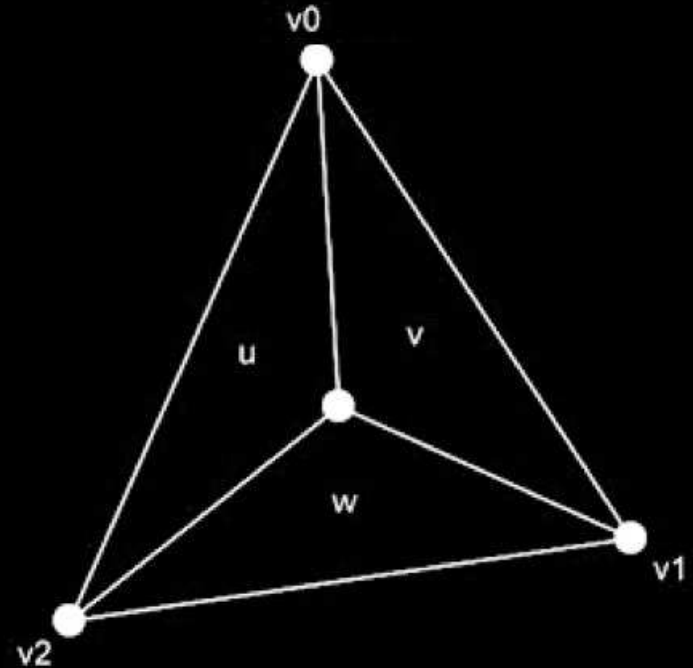
Assuming that the light source has an intensity (brightness) of 1.0 and that the surface has a specular exponent of 141:

What would be the specular illumination brightness of the surface point when viewed from a camera at [-163, 4, -18] rounding your answer to the nearest two decimal places.

## 2D Colour Interpolation

The colours of the three vertices, expressed as [Red, Green, Blue] triples with a range of (0-255) are as follows:

- Colour of  $v_0$  is [201, 32, 39]
- Colour of  $v_1$  is [51, 227, 53]
- Colour of  $v_2$  is [33, 43, 200]



If these three colours were interpolated across the surface of the triangle, what would be the colour of the pixel given by:  $u=0.28$   $v=0.29$   $w=0.43$  ? Provide your answer as a [Red, Green, Blue] triple with each channel rounded to the nearest whole number.

Hopefully you get the idea...

How workbook tasks

Translate into potential exam questions !



# Precision

Be as precise as you can during calculations  
(to avoid accumulated rounding errors)

You will be asked to round answers to 2DP  
(make sure you round to the nearest 2DP !)

Marking will accept a small variation from solution  
(we'll be able to tell if your approach is right)

# Upload your workings

At end of exam you'll be able to upload workings

Lets you show outcome of each stage of process

Even if using digital tools this is still worth doing

Even if you don't get the final answer correct

You may still get some marks for method

Questions ?