Interpolation and Approximation of functions Part 1

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Some parts in
Textbook Chapter 9

1

Today

- Clarification: Note that Phong reflection model uses different colors for each of it's components
  - diffuse color (of object), specular color (of light source), etc.
- Assignment 2 results
- Quiz 2 preparation tips
- Interpolation and approximation

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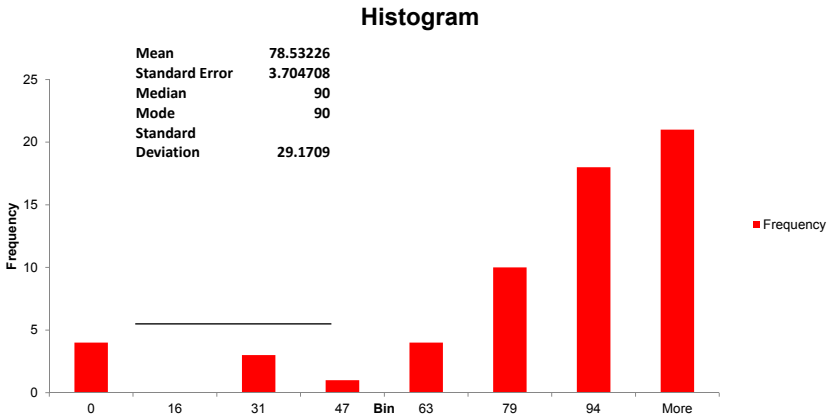
Assignment 2

- Grades will be uploaded later today, Spotlights on Friday



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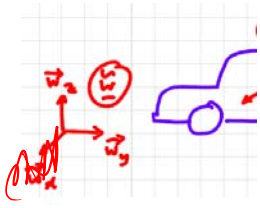
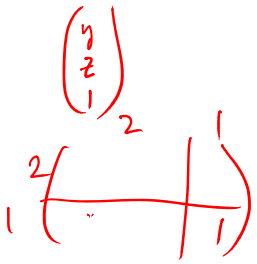
Quiz 2 Preparation Tips

- Format will be similar to Quiz 1
- Can skip Chapter 9 (Interpolation)
- Expect 2D problems, as in Quiz 1. E.g., will ignore x coordinate and have just y and z basis vectors. Homogeneous coordinates will be 2+1 = 3 dimensions, etc.





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Quiz 2 Preparation Tips

- Review basic Three.js and GLSL functions you used in assignments
- Know inverses of simple transformations, e.g.,
  - Translation by t
  - rotation about an axis by theta
  - scale by s

scale(1/s) Rot(-θ) $\begin{pmatrix} I & -t \\ \hline 0 & 1 \end{pmatrix}$

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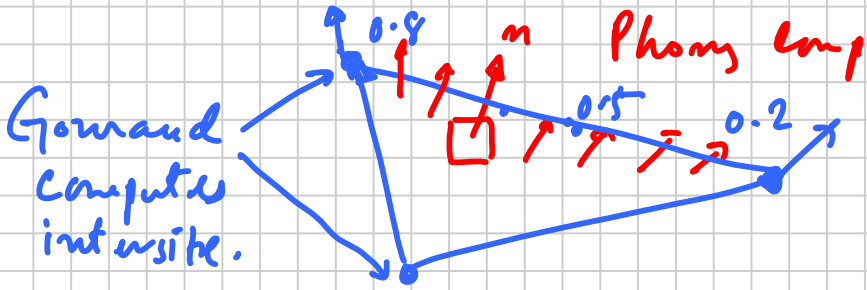
Interpolation & Approximation

Note Title 2015-03-02

Gouraud shading and Phong shading can use the SAME reflection model



Gouraud computes intensities.

Phong computes this per fragment, using interpolated normals

☆ By declaring a variable to be "varying" you tell GL to interpolate the vertex values to each fragment.

Motivation:

Discrete / Digital representation of Continuous / Analog functions

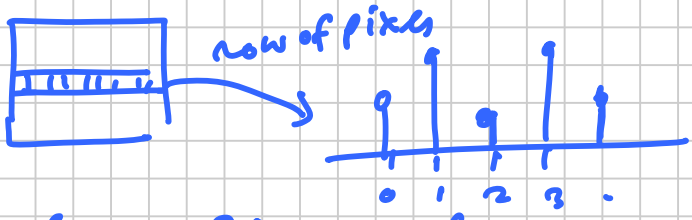
Key questions:

Reconstruction (Interpolation is one way to achieve this)

A widespread problem. Some examples:

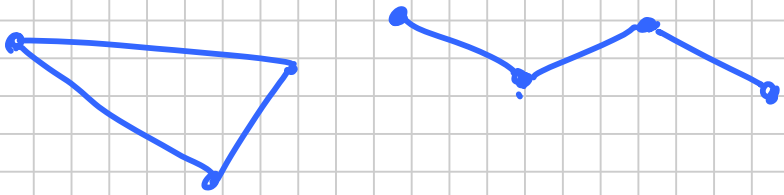
- Sound / Audio
  - eg CD quality, sampled at 44.1 KHz
  - Has to be high enough to avoid "aliasing"

- Images



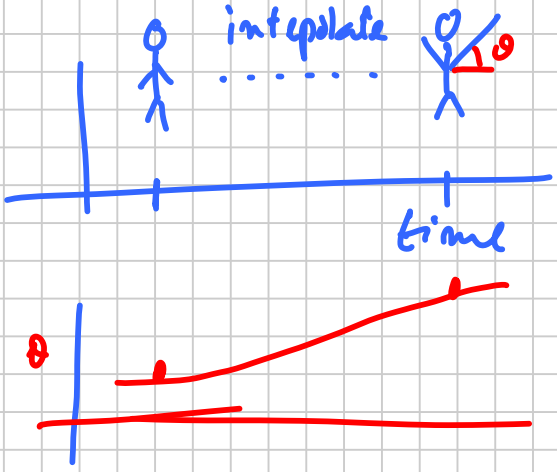
Can think of as a 2D signal

- Meshes



Also discrete but not as obvious what the independent (x) variable is here...

- Computer animation with keyframes



We'll focus on 1D interpolation
- easy to work out
- easy to generalize to higher dimension

§ Constant "interpolation"

Positives: very simple

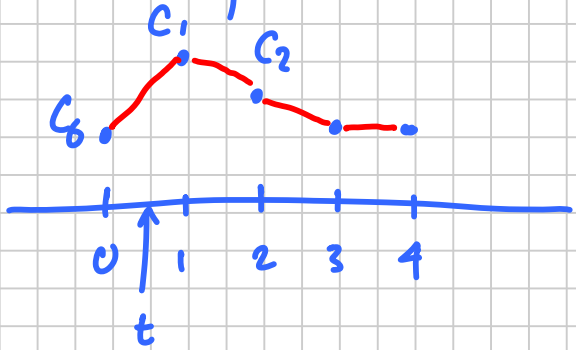
Limitation: not continuous

Important case to keep in mind.

Eg:- Between pixels, we effectively have constant interp

- toon shading

§ Linear Interpolation



Evaluate $c(t) = at + b$ Eqn of a straight line

Pick a, b so that it passes through c_0 and c_1

$t=0 \Rightarrow c_0 = a \cdot 0 + b = b \Rightarrow b = c_0$

$t=1 \Rightarrow c_1 = a \cdot 1 + b = a + b \Rightarrow a = c_1 - c_0$

$$c(t) = (c_1 - c_0)\, t + c_0$$

Key Step: Rewrite

$$C(t) = C_0 (1-t) + C_1 t$$