Sampling 2

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Textbook Chapter 16

Several slides courtesy of M. Kim

Today

- Announcements
  - Reminder: Quiz 3 on Friday Nov 17
- Quiz 3 preparation
- Quiz 3 practice questions
- Texture Viewport
- Sampling and Aliasing
Quiz 3 Preparation

- In class, Friday November 17. Please be on time.
- Review lecture notes, and assignments.
- Everything covered in lecture could be on the exam
- Everything covered in listed textbook chapters could be on the exam
- Doing first part of Assignment 4 will be very helpful

Quiz 3 Preparation

- Textbook. Read ALL of these, except as noted
  - Ch 15 Texture Mapping. Main focus of quiz
  - Ch 3.6 Transforming normals. L19
  - Ch 9.1. Interpolation focus on L23,L24
  - Ch12.3. Texture viewport L27
  - Ch 16.1,16.2,16.3 (portion covered till Wednesday)
  - Projection. Mainly focus on recent lectures on use with projector textures and shadow mapping. Skim Ch 10, 11.3

- Topics from Quiz 1 and 2 will be assumed as pre-requisites (e.g., it is assumed you now know coordinate frames, transformations, etc.)
Q3 Practice Problem 1

- A texture map with the letters “ABCD” is mapped onto the given triangle. The \((s, t)\) texture coordinates of \(P_1\), \(P_2\), and \(P_3\) are \((0.5, 0.5)\), \((0, 0)\), and \((0.5, 0)\), respectively. Draw the textured triangle.

Q3 Practice Problem 2

- The circle of radius \(\sqrt{2}\) is textured with projector map. The projector is located at \((1,4)\) with the field of view and texture image shown in the figure. What is the texture coordinate of the point \(\bar{p}\) located at \((1,1)\)?
Viewport

- Convention in text: pixel centers are integers.
- Warning: OpenGL docs usually assume bottom left corner of each pixel has integer coordinates.
- Pixels are not points!

Viewport matrix

- We need a transform that maps the lower left corner to \([-0.5, -0.5]\) and upper right corner to \([W - 0.5, H - 0.5]\).  
- The appropriate scale and shift can be done using the viewport matrix:

\[
\begin{bmatrix}
  x_w \\
  y_w \\
  z_w \\
  1
\end{bmatrix}
= \begin{bmatrix}
  W/2 & 0 & 0 & (W-1)/2 \\
  0 & H/2 & 0 & (H-1)/2 \\
  0 & 0 & 1/2 & 1/2 \\
  0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
  x_n \\
  y_n \\
  z_n \\
  1
\end{bmatrix}
\]
Sampling

Recap: Aliasing and anti-aliasing

- Aliasing
- Anti-aliasing (multi-sampling)
- Anti-aliasing (super-sampling)
Aliasing

- The heart of the problem: too much information in one pixel

Anti-aliasing

- Intuitively: the single sample is a bad value, we would be better off setting the pixel value using some kind of average value over some appropriate region.
- In the above examples, perhaps some gray value.
Image in 1D

Continuous

Approximate with $I[x]$  

Box filter: Average over a pixel

Oversampling: Approximate

$$\frac{\int I(x)}{\text{length}} = \frac{\sum I[x]}{\text{samples in pixel} \over \text{number of samples}}$$