Sampling 2

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Textbook Chapter 16

Several slides courtesy of M. Kim

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Today

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

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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

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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.)

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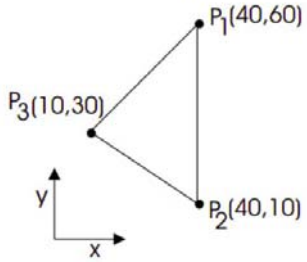
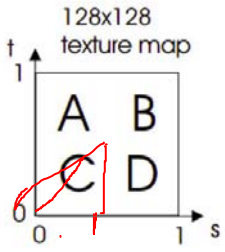
Q3 Practice Problem 1

- 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.





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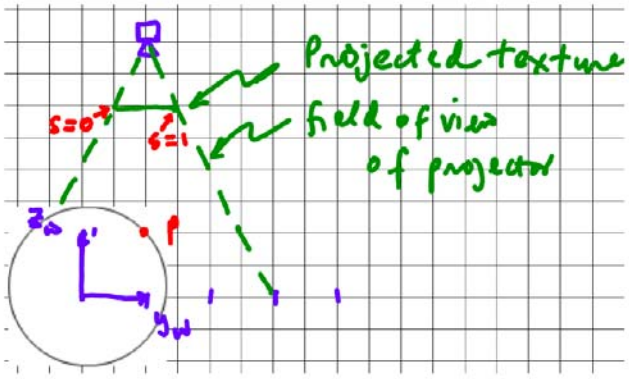
Q3 Practice Problem 2

- 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 $\tilde{p}$ located at (1,1)?



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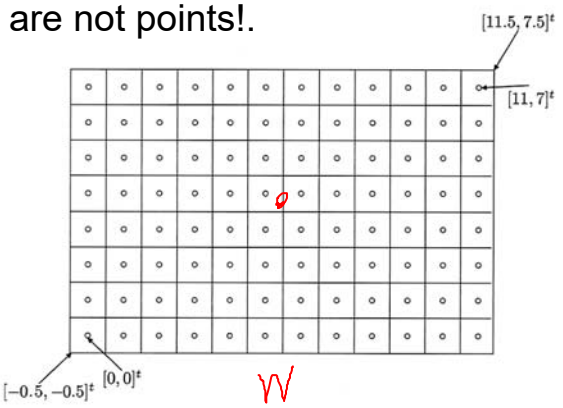
Viewport

- 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!.



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Viewport matrix

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

$$\begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix} = \left[\begin{array}{ccc|c} W/2 & 0 & 0 & (W-1)/2 \\ 0 & H/2 & 0 & (H-1)/2 \\ 0 & 0 & 1/2 & 1/2 \\ \hline 0 & 0 & 0 & 1 \end{array}\right] \begin{bmatrix} x_n \\ y_n \\ z_n \\ 1 \end{bmatrix}$$

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Sampling

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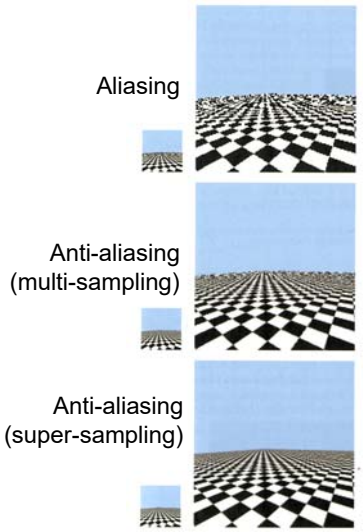
Recap: Aliasing and anti-aliasing



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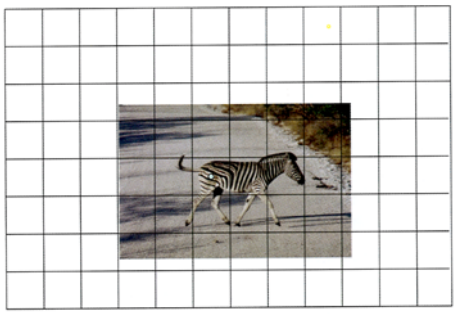
Aliasing

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



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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.

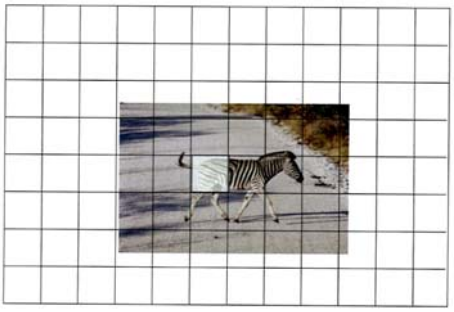

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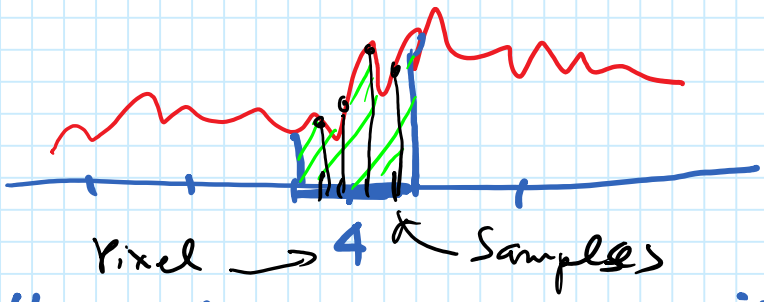
Image in 1D

November 15, 2017 10:45 AM

Continuous

$I(x)$



Approximate with $I[x]$

Box filter: Average over a pixel

Oversampling: Approximate

$$\frac{\int I(x)}{\text{length}} \approx \frac{\sum_{\text{samples in pixel}} I[x]}{\text{number of samples } N}$$