Texture Mapping

CS418 Computer Graphics

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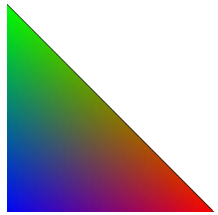
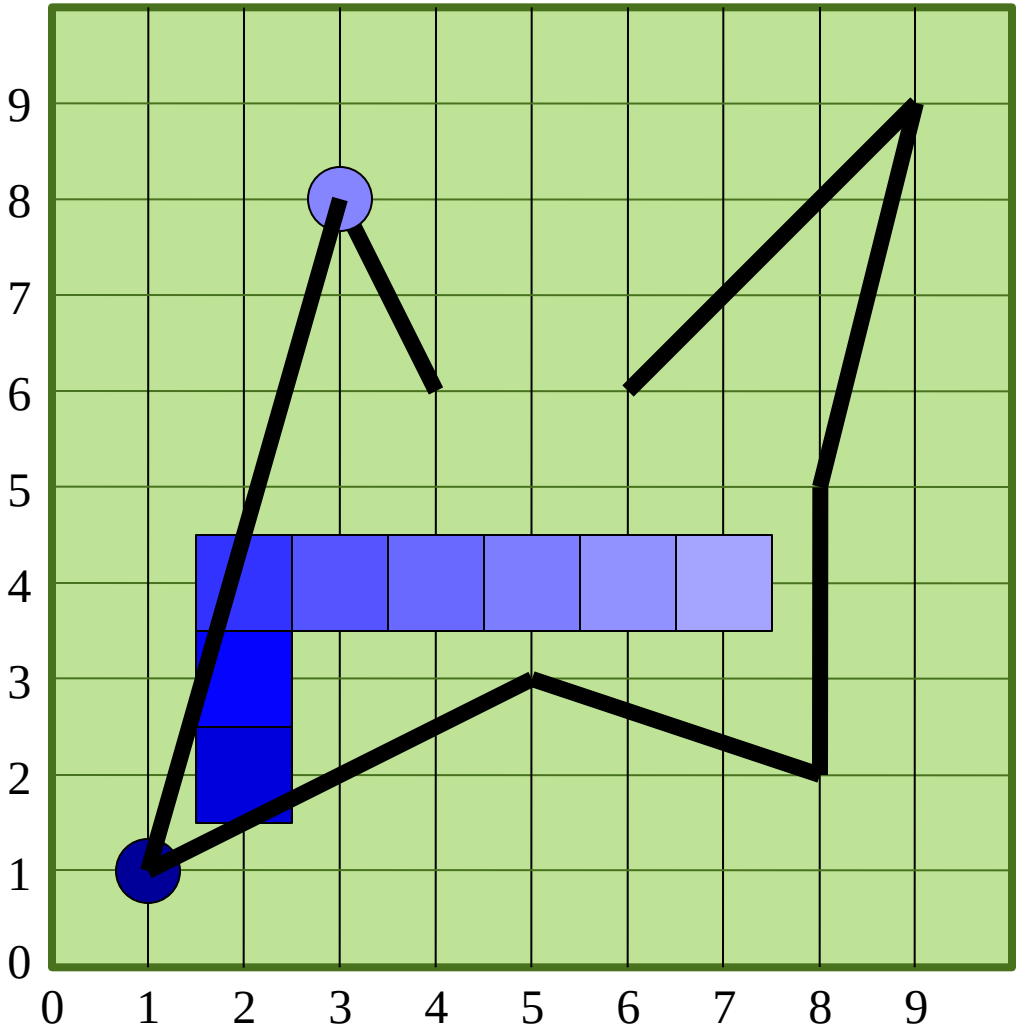
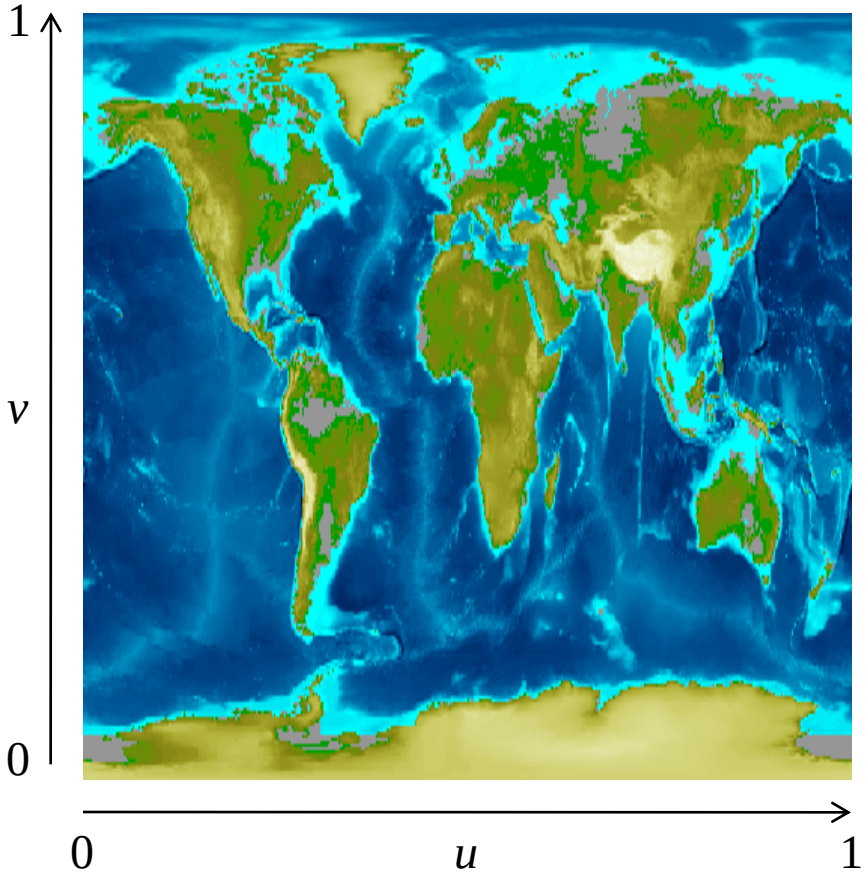
Interpolation

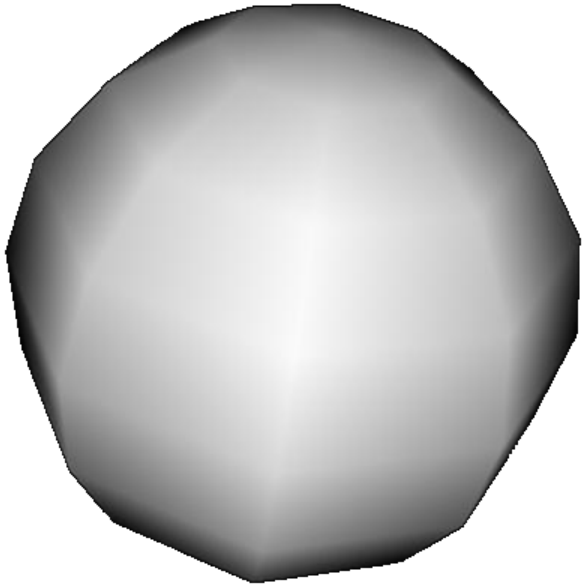


- Rasterization will interpolate any vertex attribute across a polygon's fragments
- Interpolating color yields Gouraud smooth shading
- Can also define texture coordinates (u,v) at vertices that, when interpolated, map an image onto a meshed surface

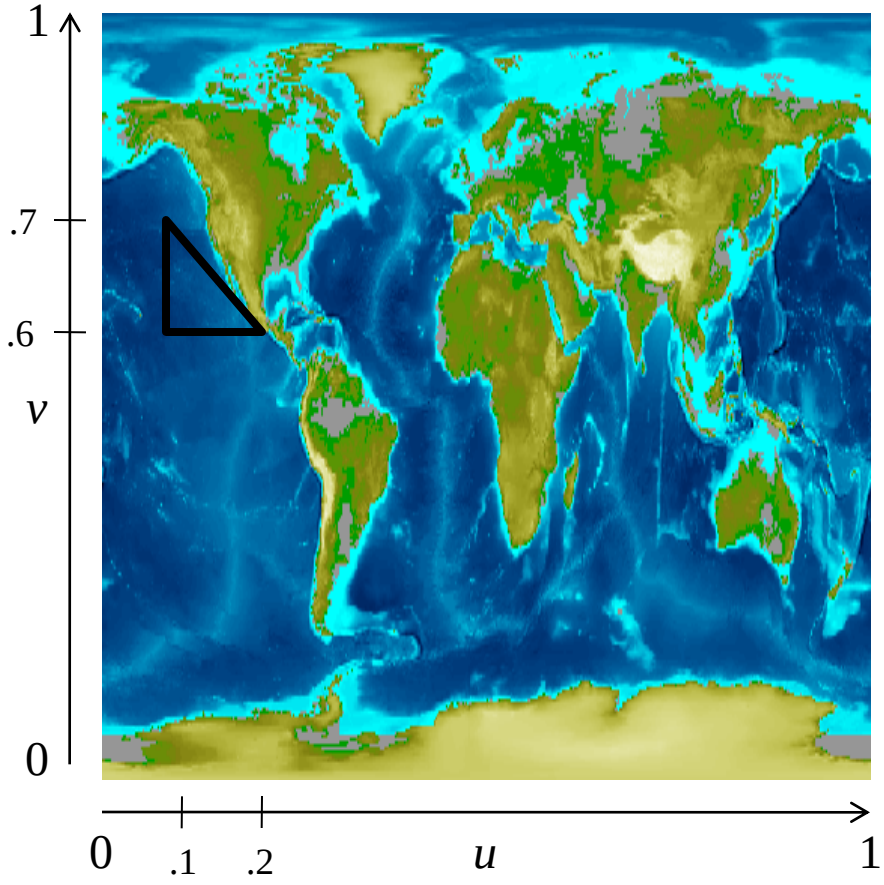


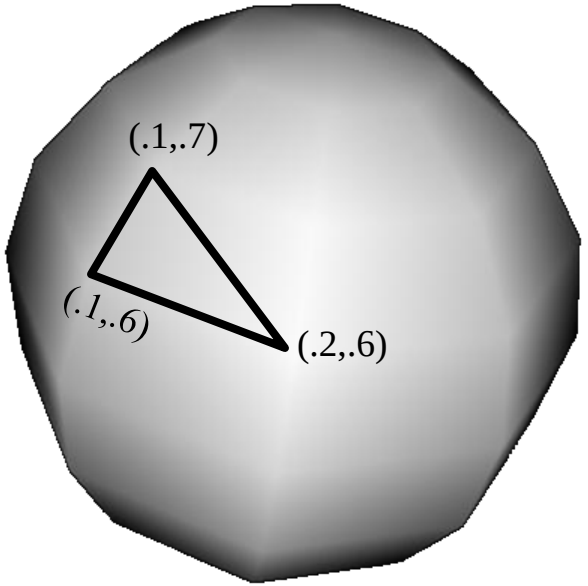
Texture Mapping



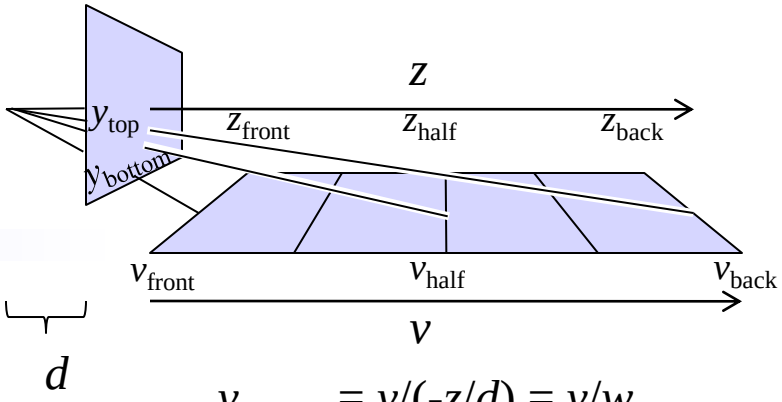


Texture Mapping



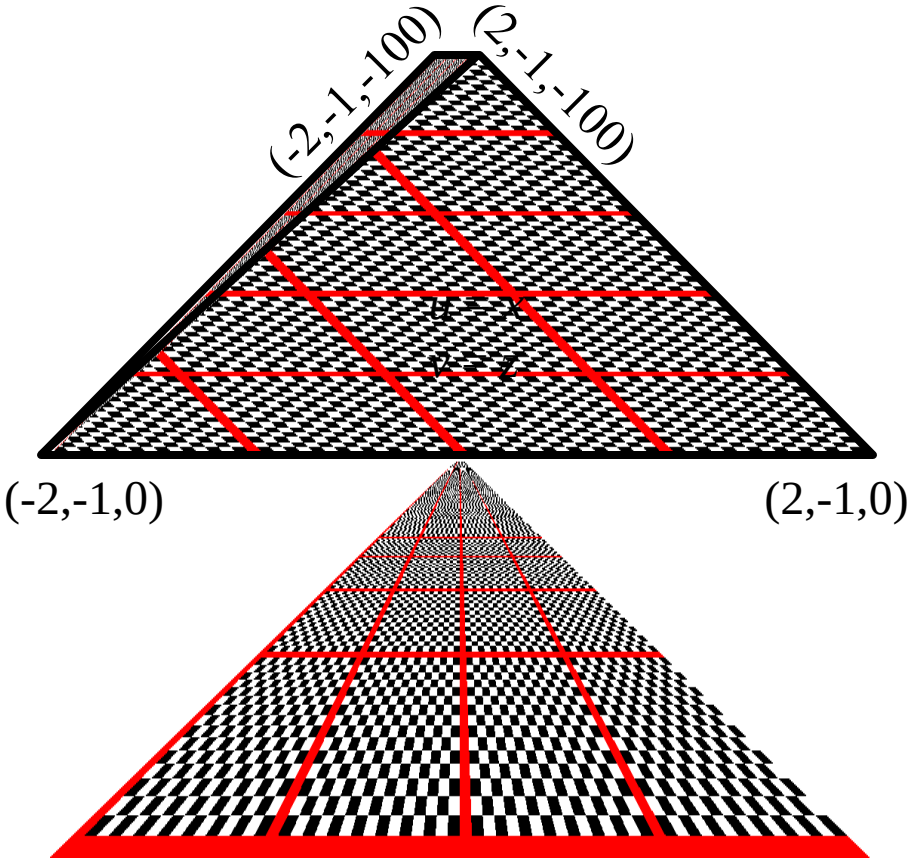


Perspective Correction



$y_{canvas} = y/(-z/d) = y/w$

- In this example:
  - y = -1, d = 1 and v = -z
  - v_{back} maps to $y_{top} = -1/-z_{back}$
  - v_{half} maps to $y_{half} = -1/-z_{half}$
  - v_{front} maps to $y_{bottom} = -1/-z_{front}$
- So need to interpolate inverse
- clip verts + attrs: (*x*,*y*,*z*,*w*,*u*,*v*,*1*)
- canvas vertices and attributes: (*x*/*w*, *y*/*w*, *z*/*w*, 1/*w*, *u*/*w*, *v*/*w*)
- interpolate: (*u*/*w*, *v*/*w*, 1/*w*)
- divide *per-pixel* by 1/*w* to get interpolated (u,v)



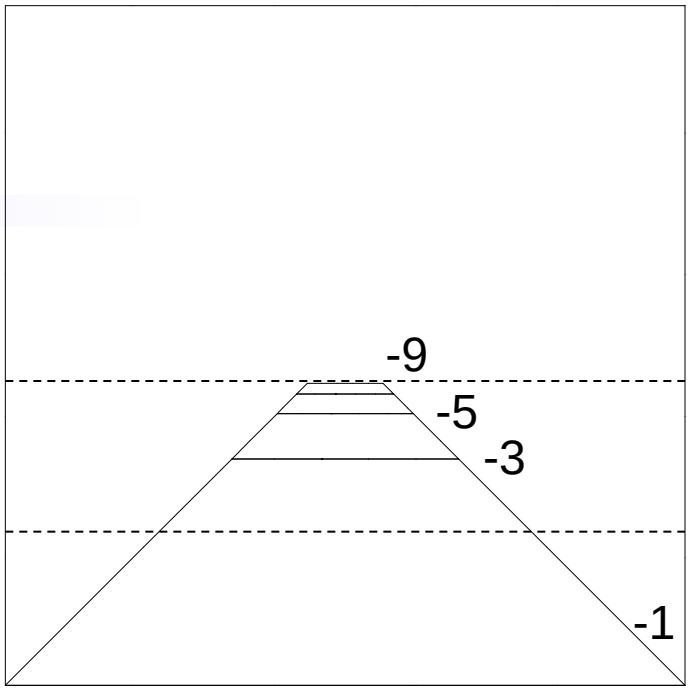
Example

$y_{canvas} = y/(-z/d) = y/w$

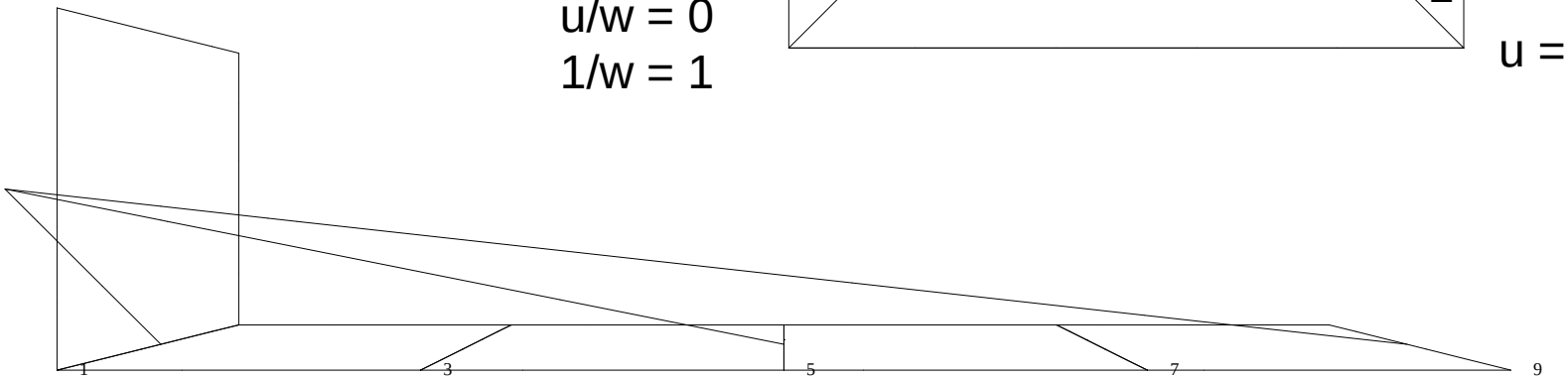
u/w = 1/9
1/w = 1/9

u/w = .5/9
1/w = 5/9

u/w = 0
1/w = 1



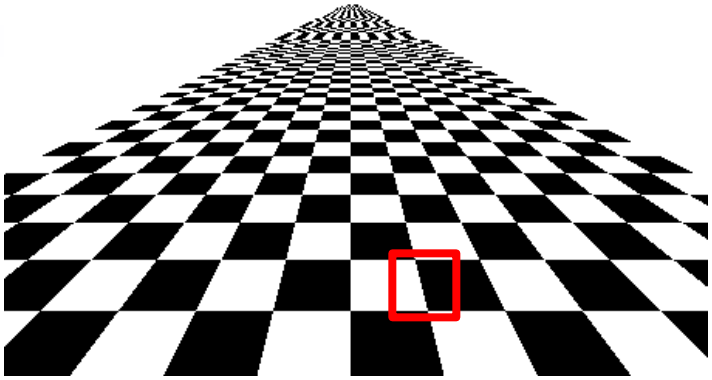
(0,0,0)

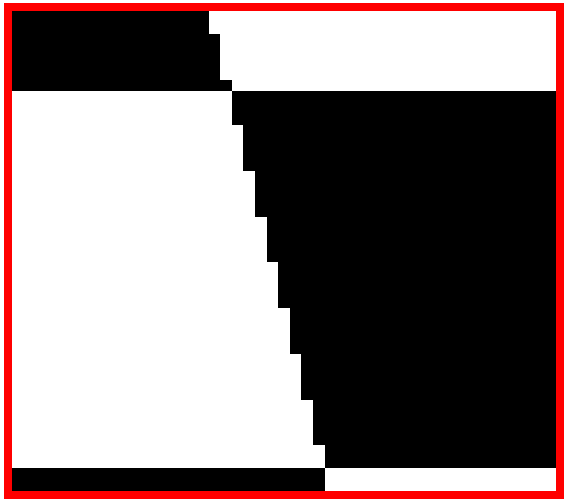


z = -1	-3	-5	-7	-9
y = -1	-1	-1	-1	-1
w = 1	3	5	7	9
u = 0	.25	.5	.75	1

Magnification Aliasing

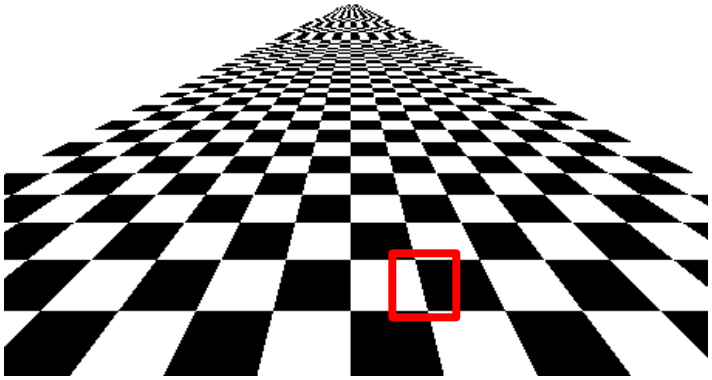
- “Jaggies” – lines have a staircased edge appearance
- Occur when a single texture sample (texels) projects to multiple screen pixels
- (Also occurs when rasterizing lines or polygon edges)

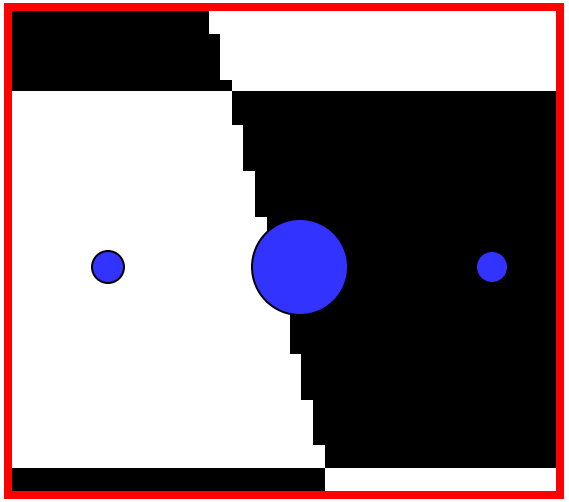




Bilinear Filtering

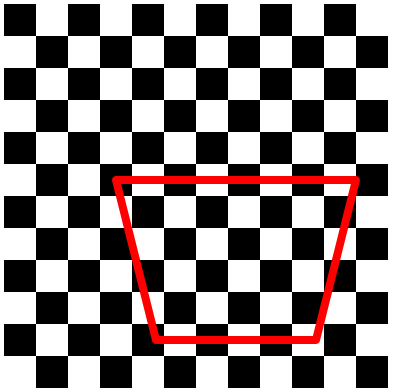
- “Jaggies” – lines have a staircased edge appearance
- Occur when a single texture sample (texels) projects to multiple screen pixels
- (Also occurs when rasterizing lines or polygon edges)
- Fixed by averaging neighboring samples to find the value between samples

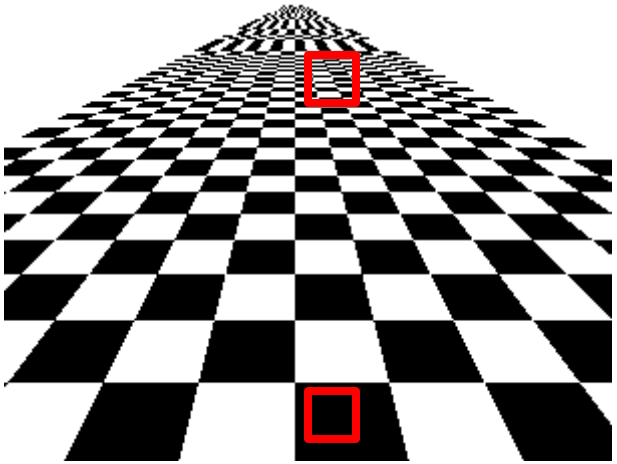


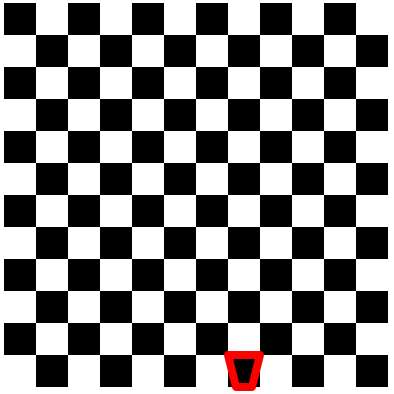


Minification Aliasing

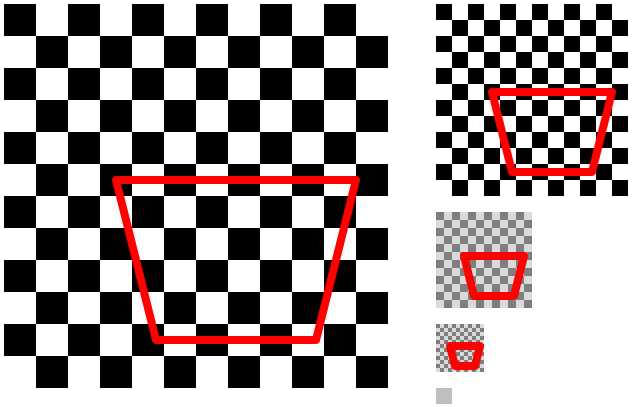
- Many texture pixels (texels) map into a single screen pixel
- Cannot simply add them up because some pixels would take longer than others to add







MIP Mapping



- Many texture pixels (texels) map into a single screen pixel
- Cannot simply add them up because some pixels would take longer than others to add
- Create an image pyramid from the initial texture
- Each level of the pyramid half the resolution of the one below it
- Choose the texture resolution whose projected texel size most closely matches pixel size