

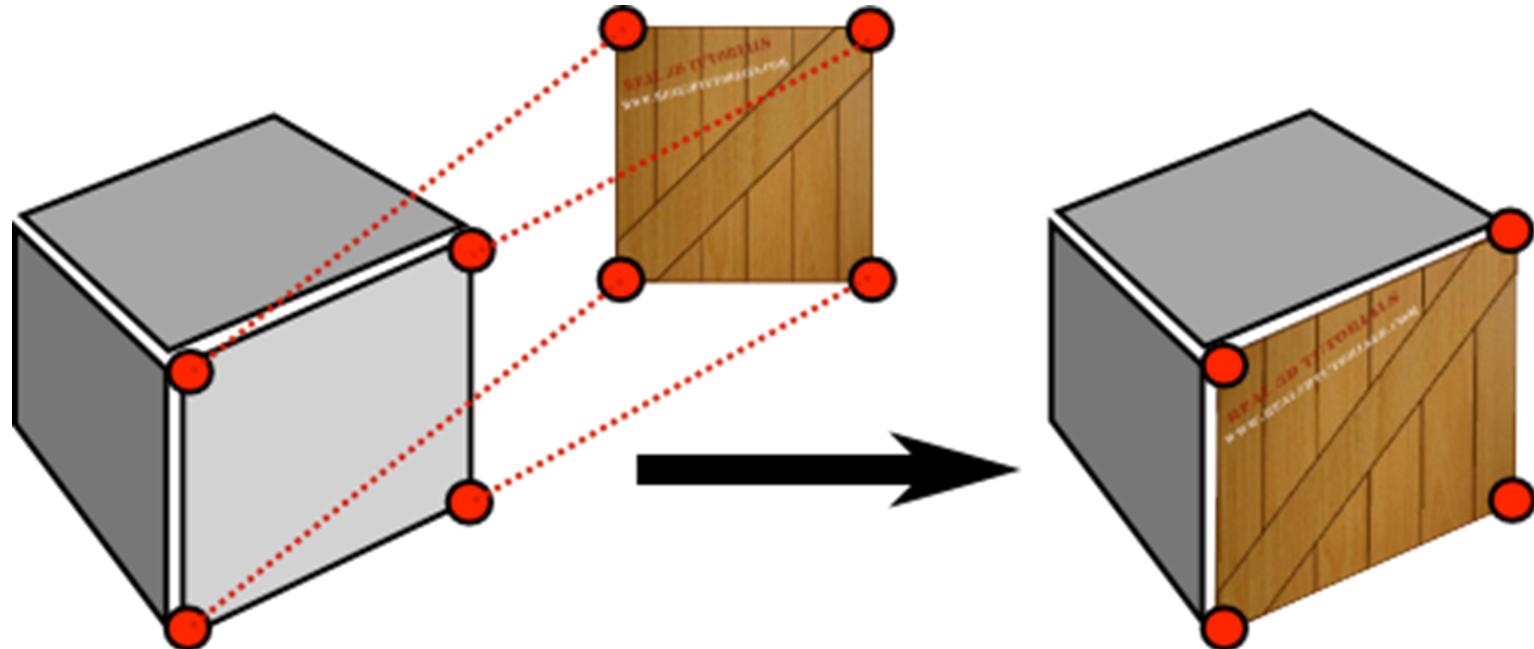
# Texture Mapping

CSCI 4611: Programming Interactive Computer Graphics and Games

Evan Suma Rosenberg | CSCI 4611 | Fall 2022

# Textures

You have a polygon mesh and an image.



Imagine the image is printed on a stretchy rubber sheet and glued onto the polygons.

# Example (Minecraft)

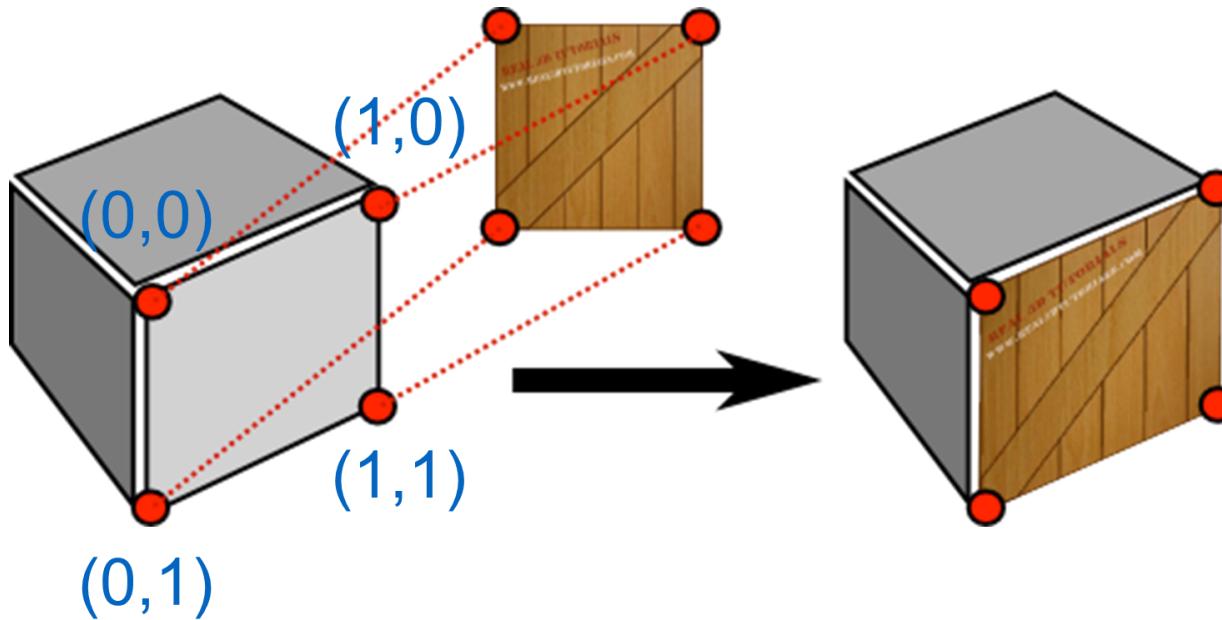


# Texture Mapping

Each vertex has a 3D position: ( $x, y, z$ )

We'll also give it 2D texture coordinates: ( $u, v$ )

The texture coordinates specify where in the 2D image that vertex's texture should come from (between 0 and 1).



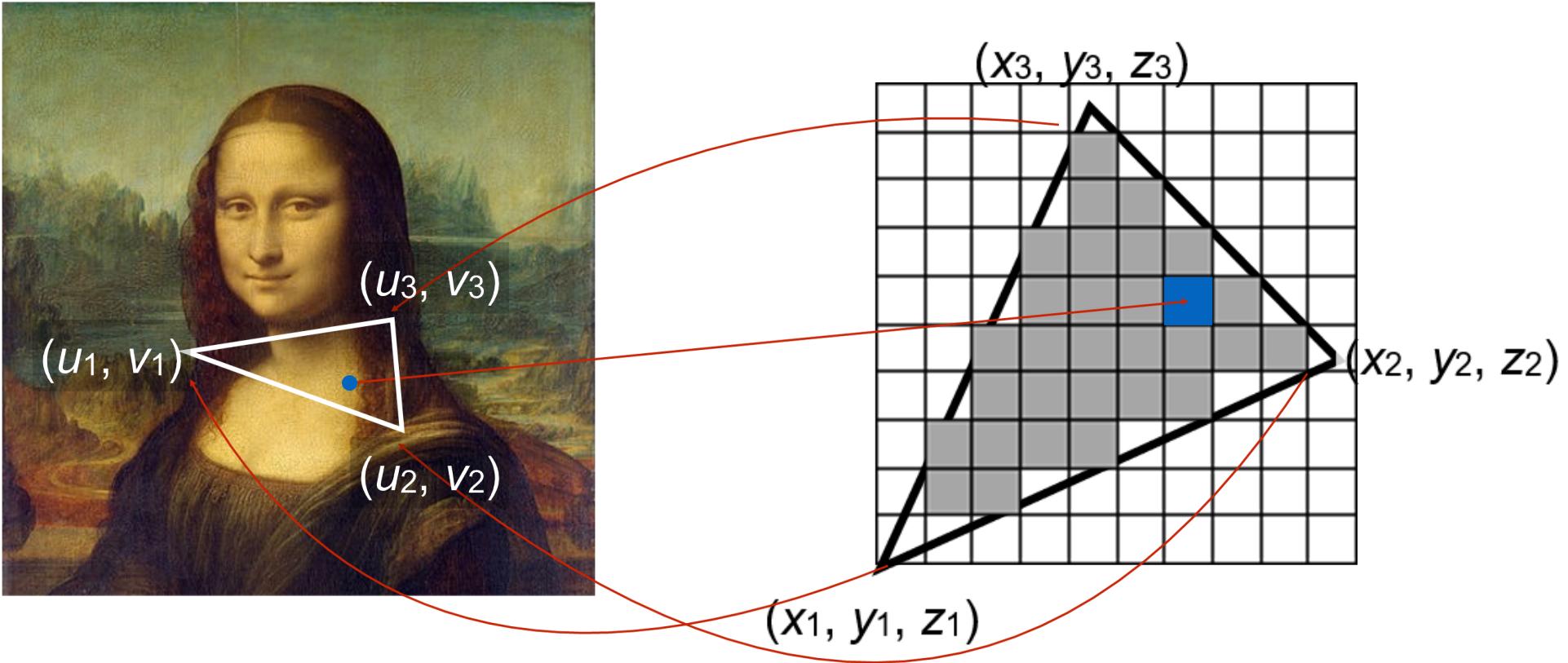
# Texture Coordinates in the Mesh Data Structure

Remember, each vertex has a 3D position (**x, y, z**) and usually also a 3D normal <**x,y,z**>.

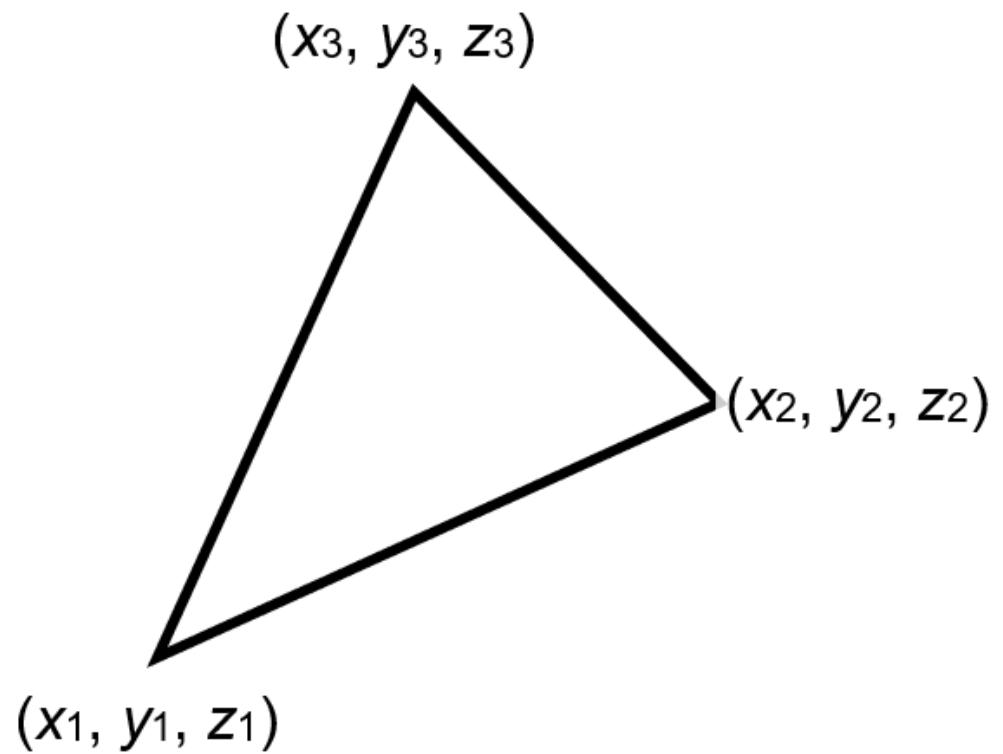
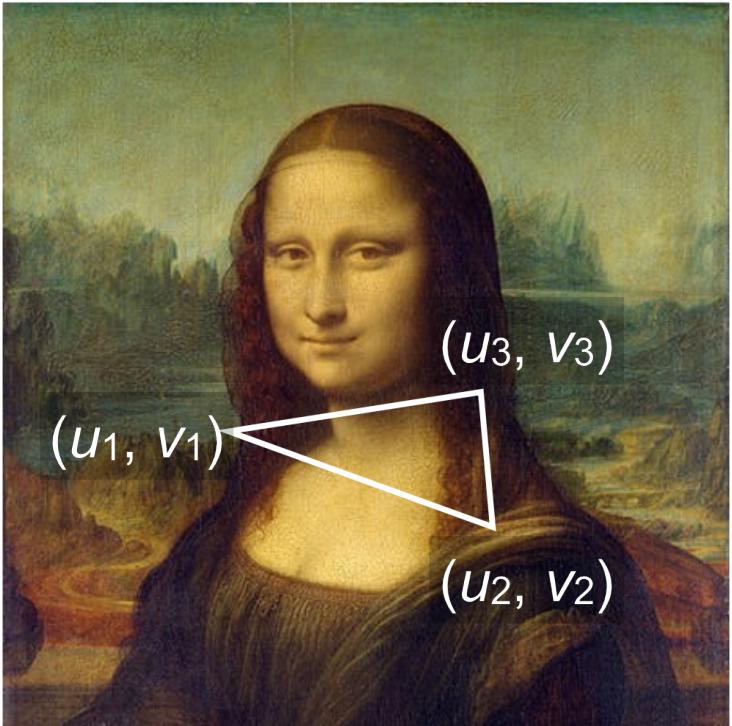
Now, we'll add one more bit of data for each vertex: (**u, v**).

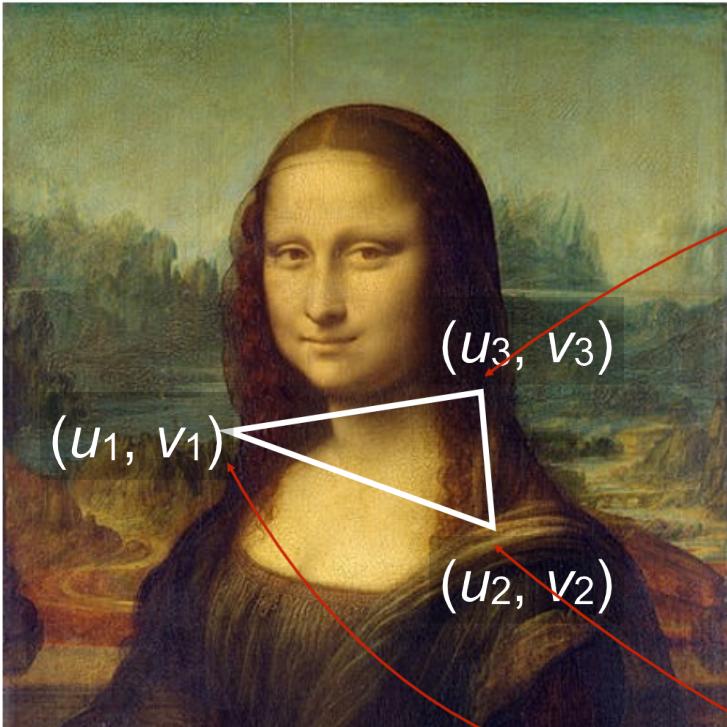
We will store it the same way, just adding one more array, with one entry per vertex.

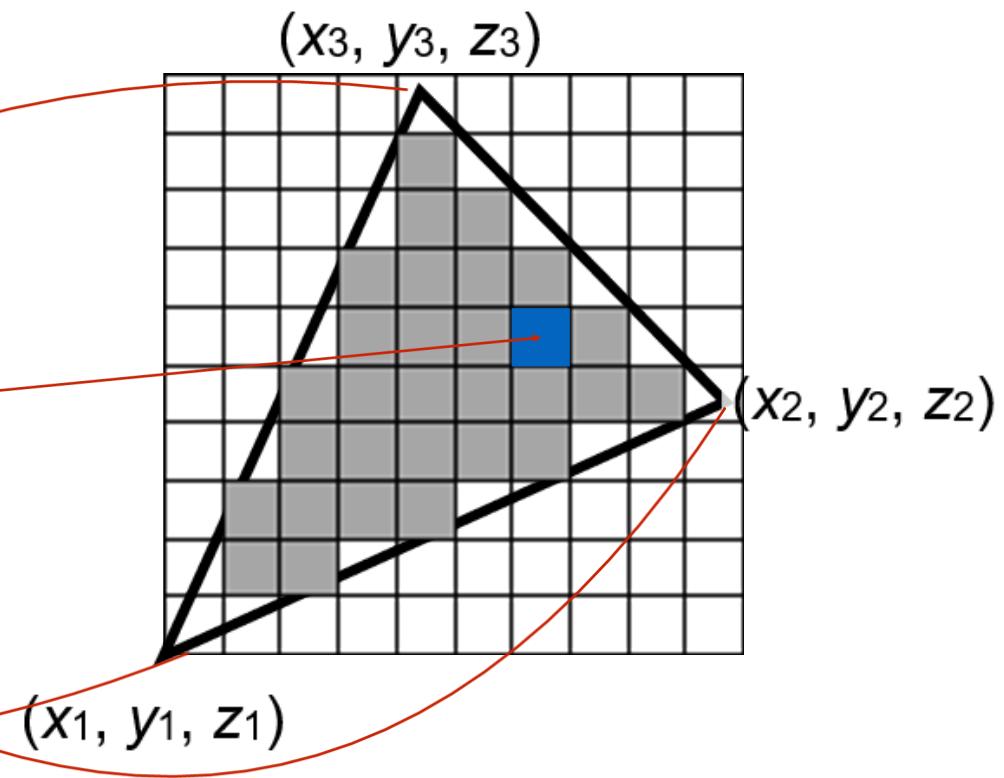
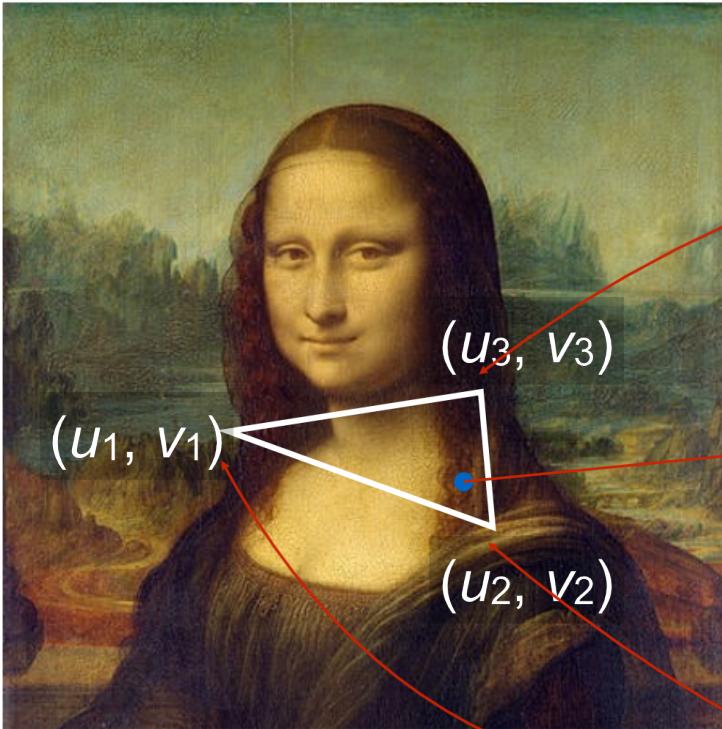
The (**u,v**) coordinates define the shape of the 2D "cookie cutter" used on the image!








$$(x_3, y_3, z_3)$$
$$(x_2, y_2, z_2)$$
$$(x_1, y_1, z_1)$$



(0,0)

(1,0)



(0,1)

(1,1)

(0,0)



(1,0)

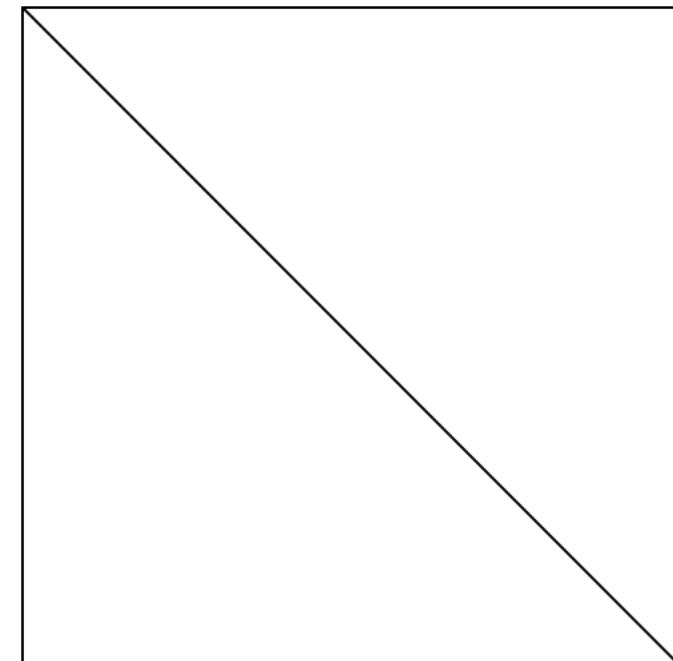
(1,1)

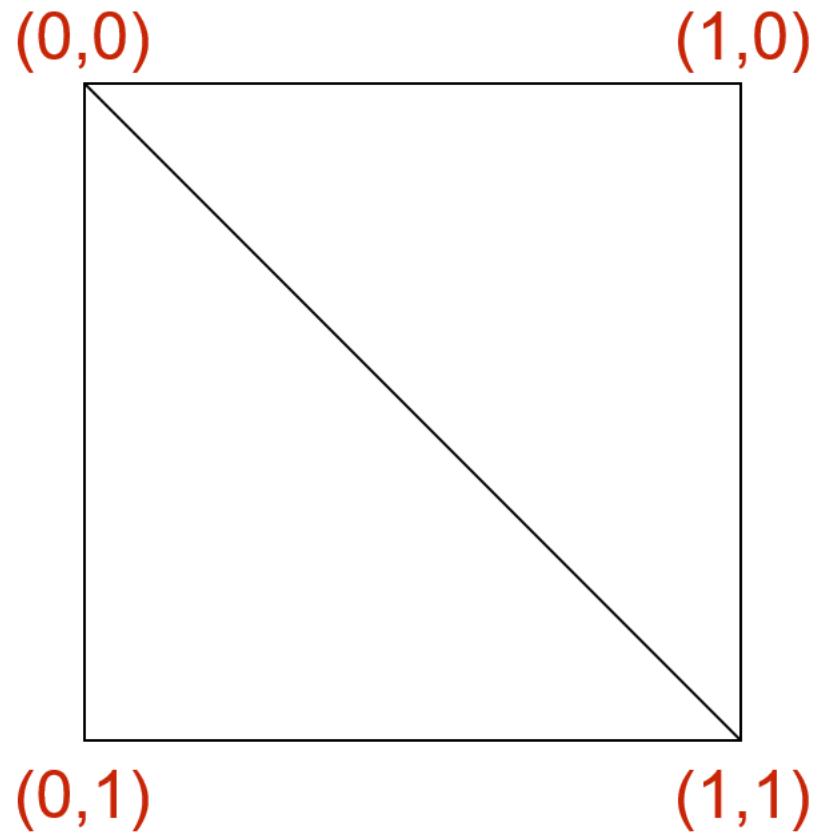
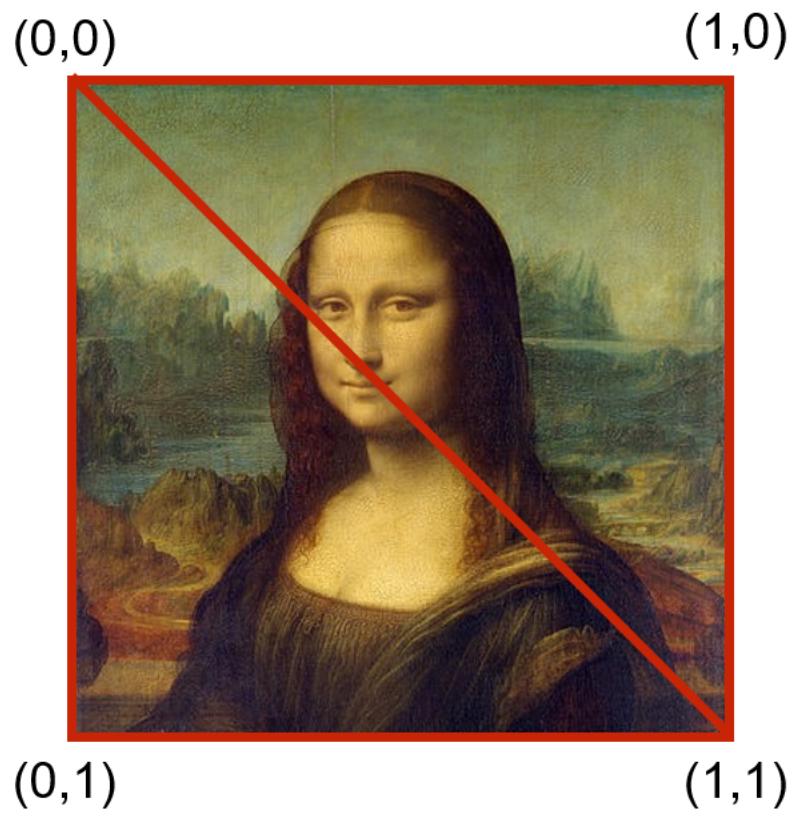
(0,0)

(1,0)

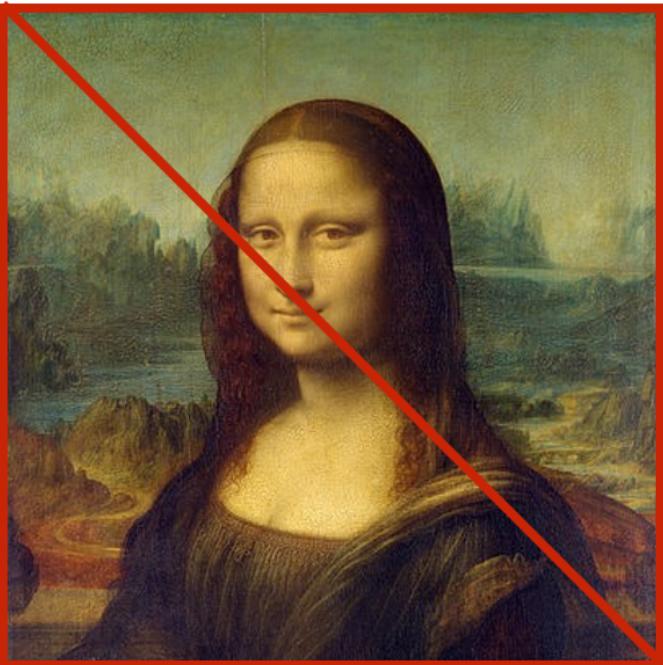
(0,1)

(1,1)



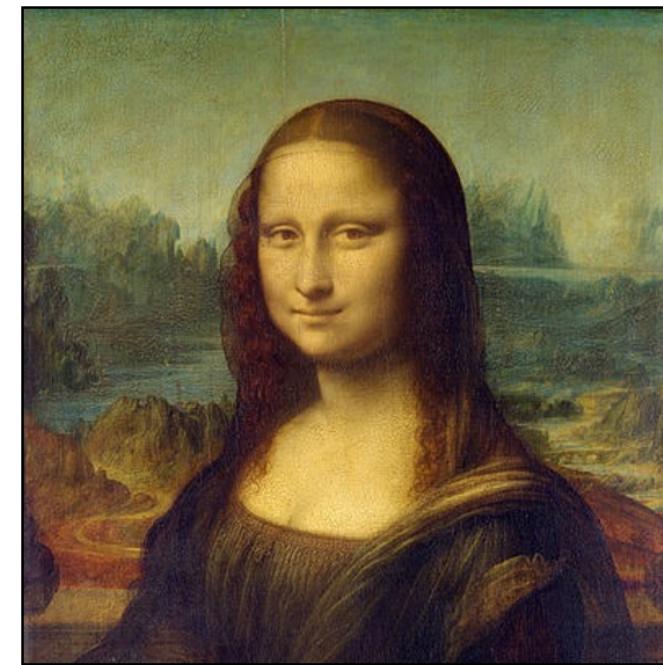


(0,0)



(1,0)

(0,0)



(1,0)

(0,1)

(1,1)

(0,1)

(1,1)

(0,0)



(1,0)

(1,1)

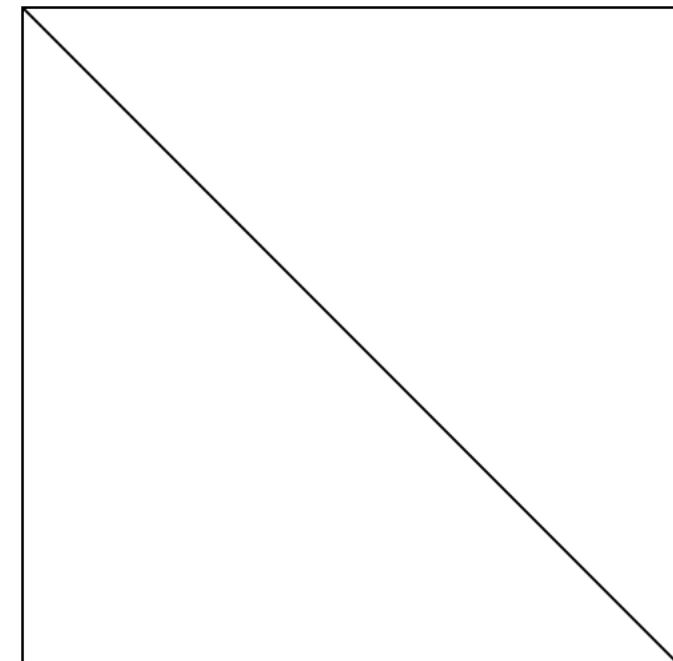
(0,1)

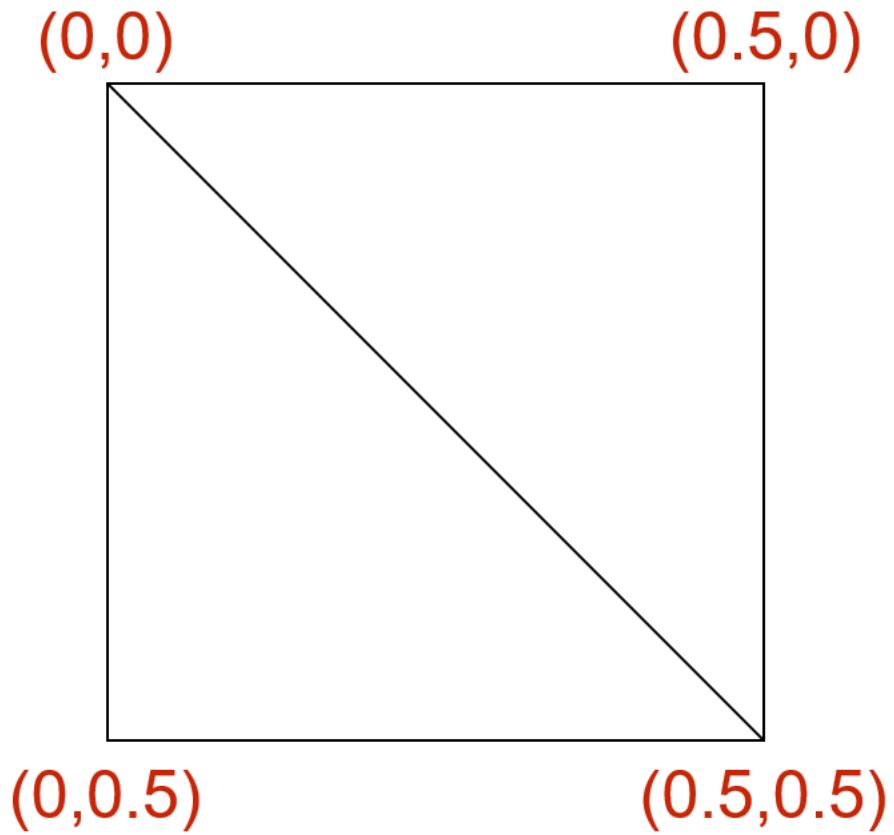
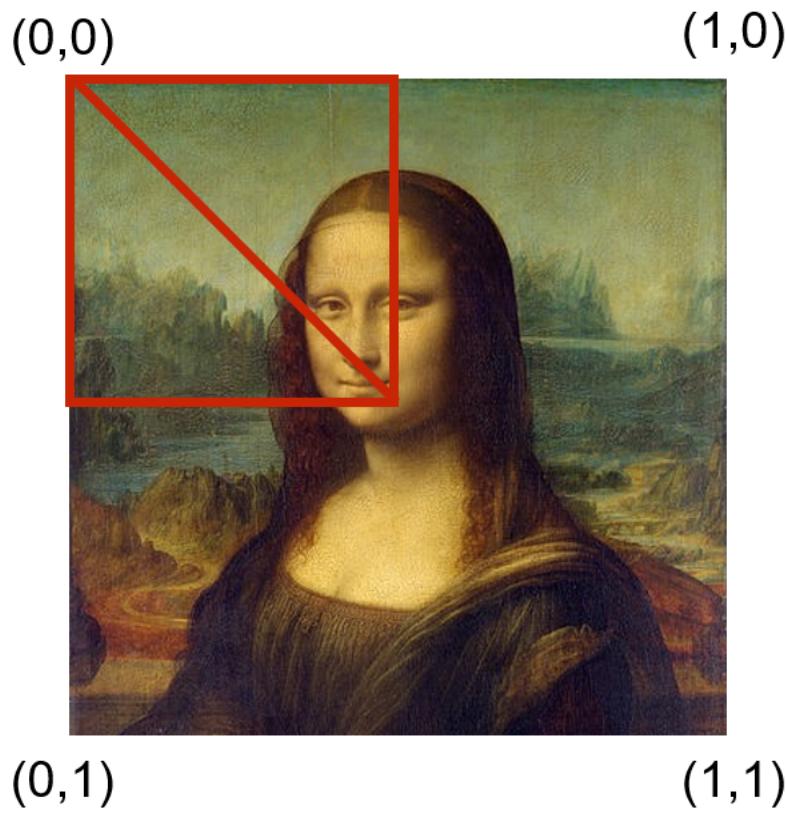
(0,0)

(0.5,0)

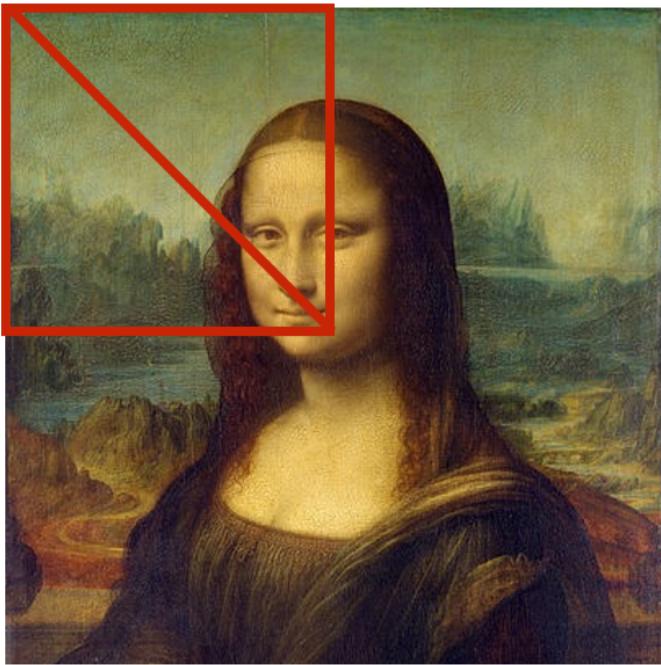
(0,0.5)

(0.5,0.5)





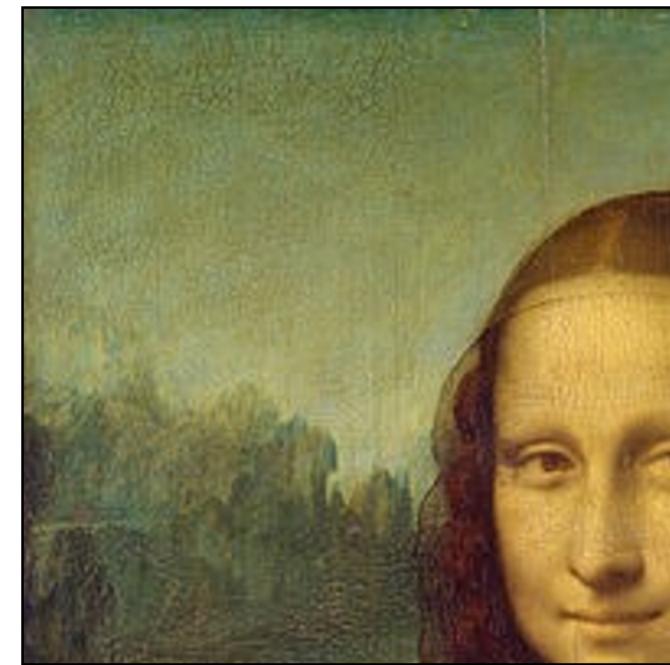
(0,0)



(1,0)

(0,0)

(0.5,0)



(0,1)

(1,1)

(0,0.5)

(0.5,0.5)

(0,0)



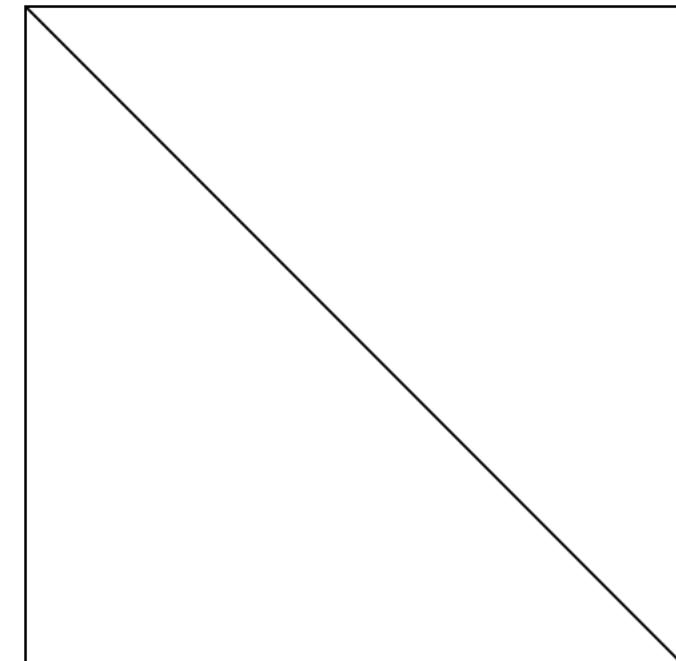
(1,0)

(0,1)

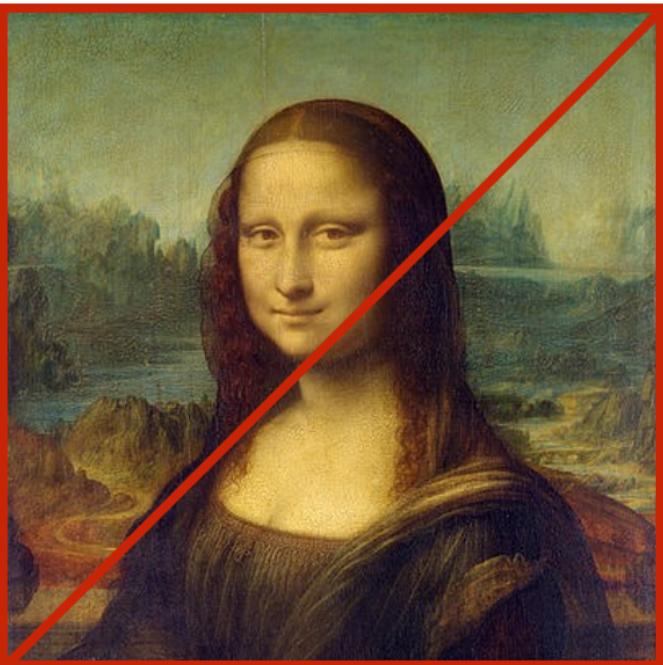
(0,0)

(1,1)

(1,0)

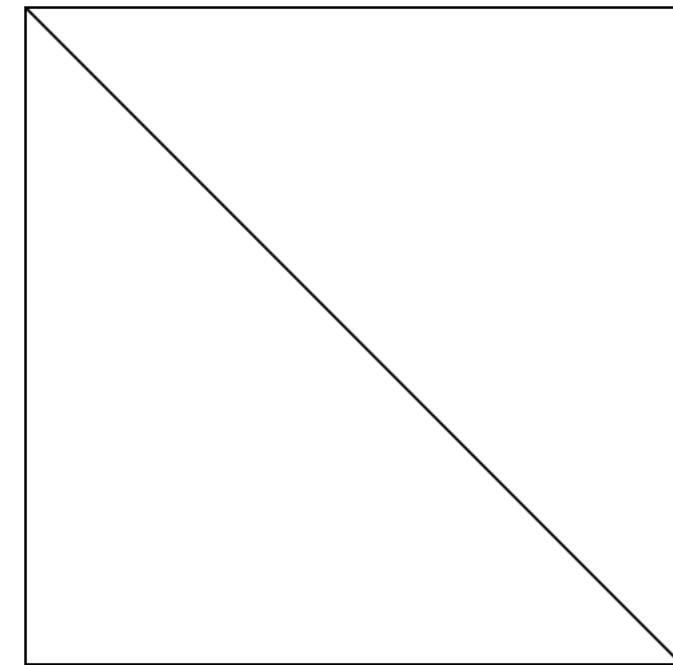


(0,0) (1,0)



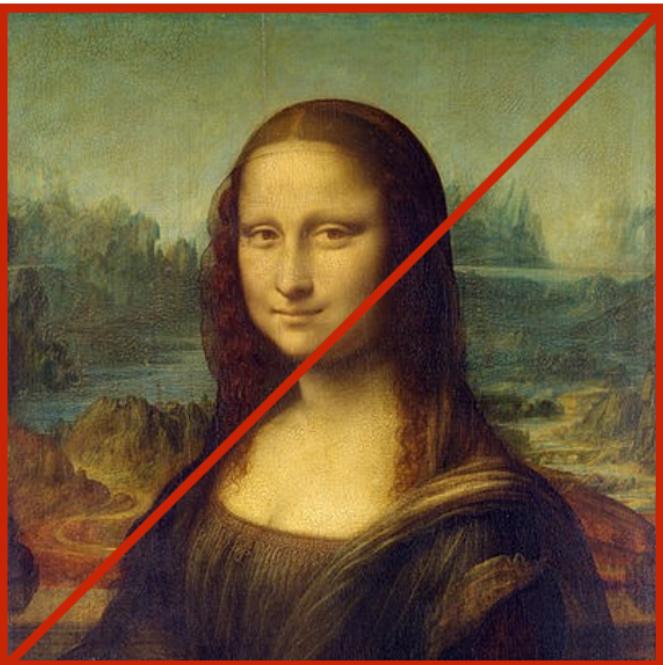
(0,1) (1,1)

(0,1) (0,0)



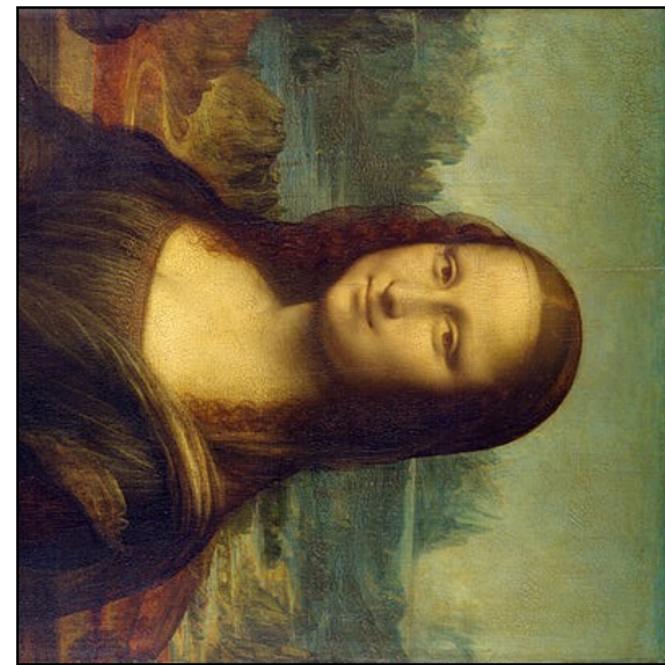
(1,1) (1,0)

(0,0)



(1,0)

(0,1)



(0,0)

(0,1)

(1,1)

(1,1)

(1,0)

(0,0)



(1,0)

(0,0.5)

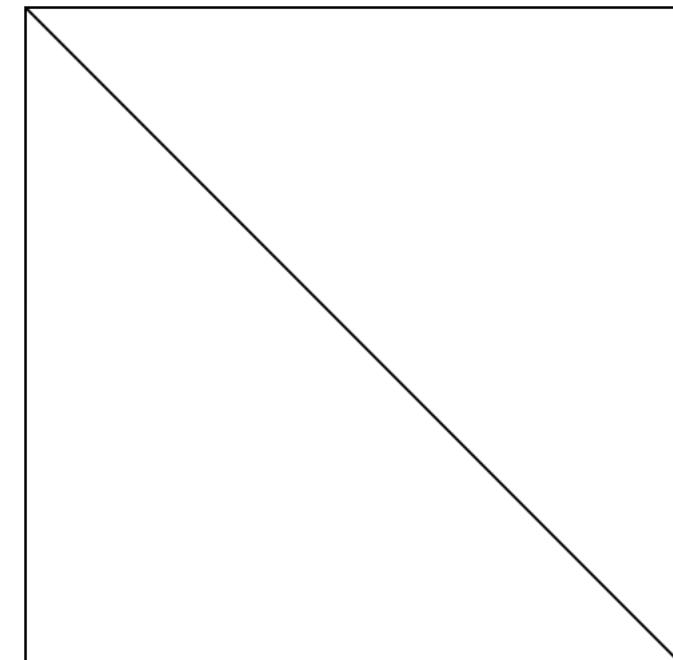
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(0,1)

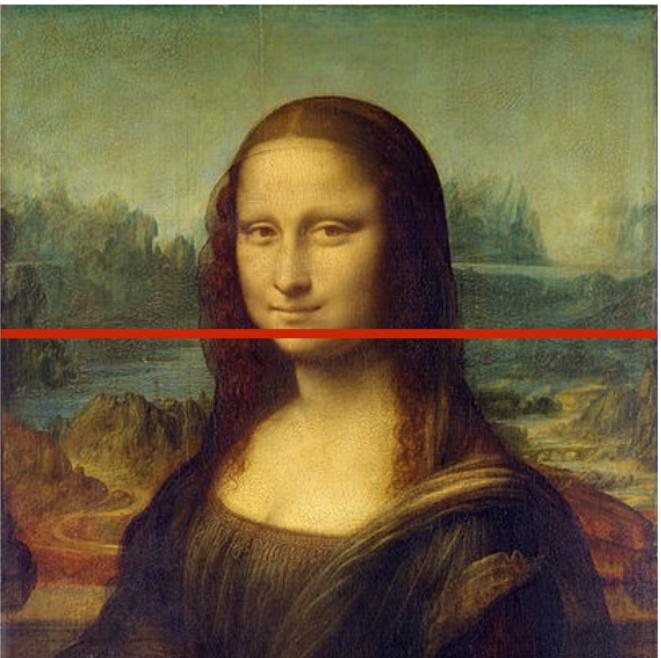
(1,1)

(0,0.5)

(1,0.5)



(0,0)



(1,0)

(0,0.5)

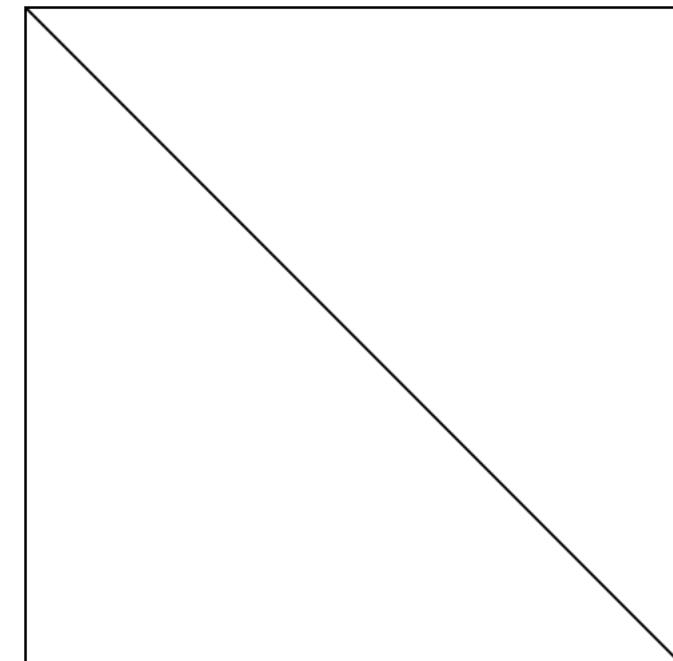
(1,0.5)

(0,1)

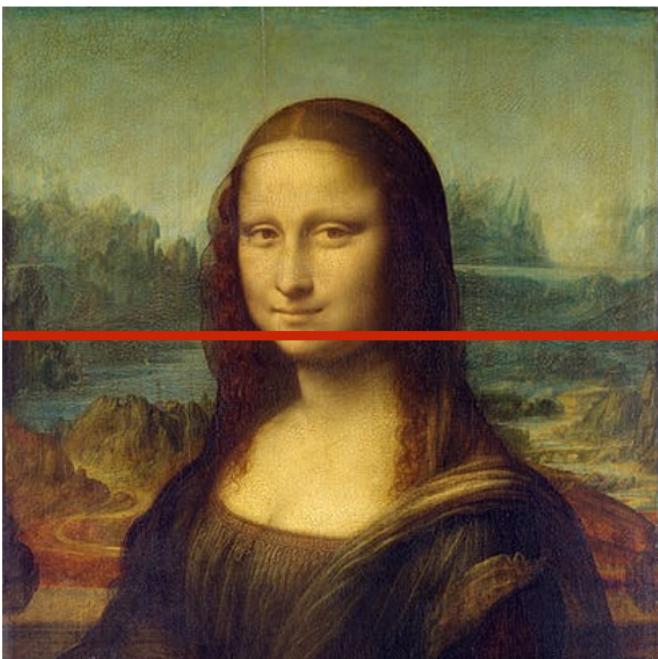
(1,1)

(0,0.5)

(1,0.5)



$(0,0)$



$(1,0)$

$(0,0.5)$

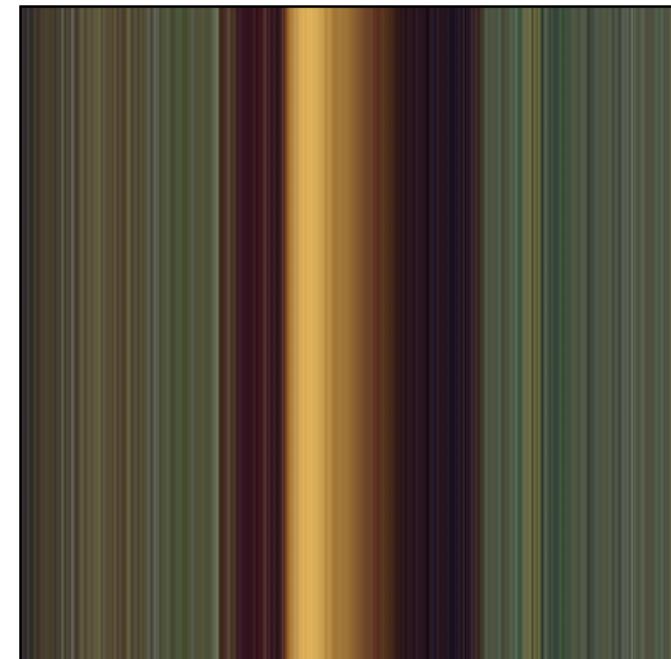
$(1,0.5)$

$(0,1)$

$(1,1)$

$(0,0.5)$

$(1,0.5)$



(0,0)



(1,0)

(0,0)

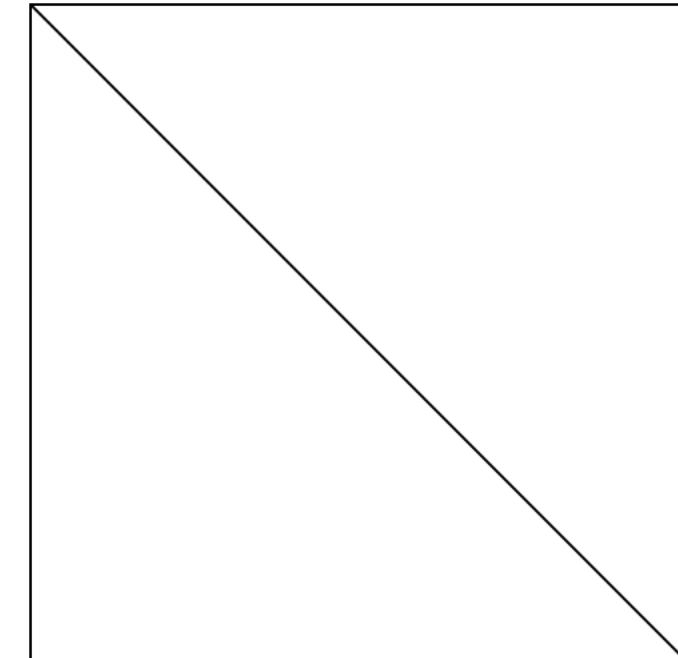
(1,0)

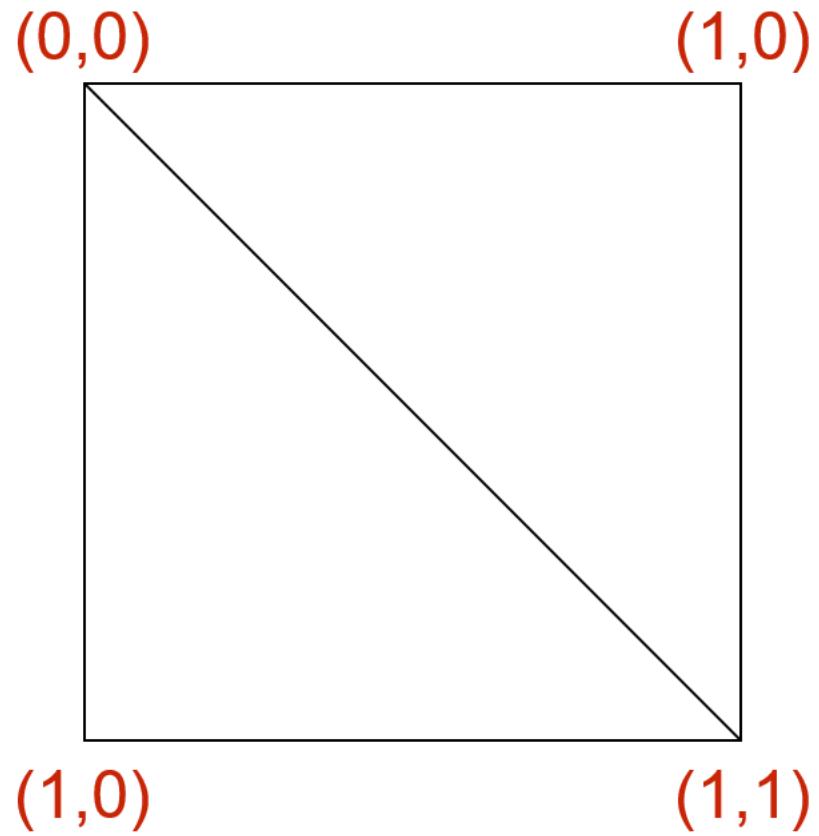
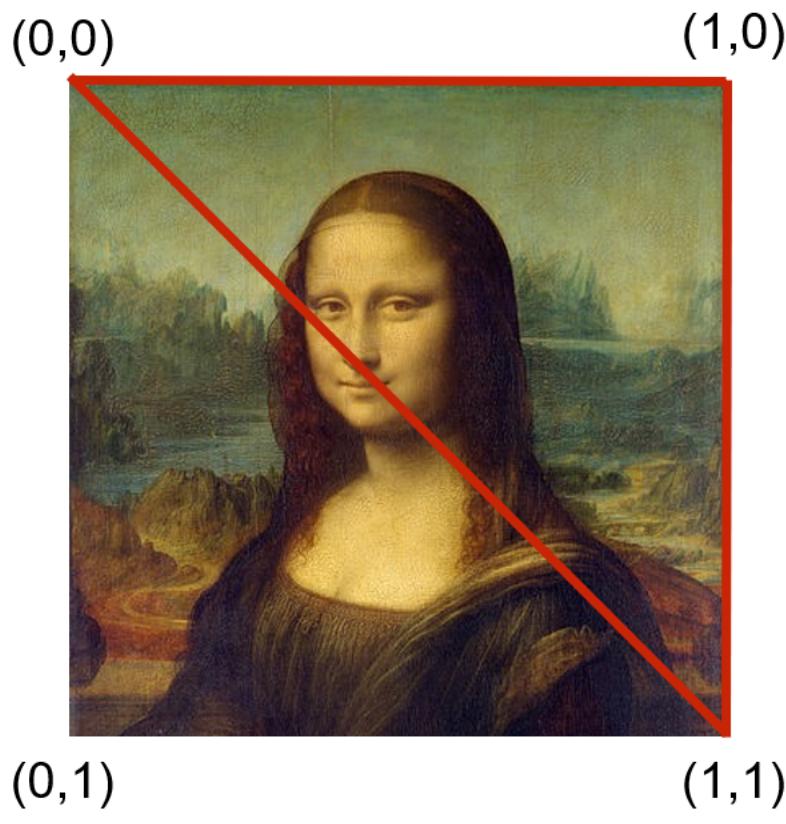
(1,0)

(1,1)

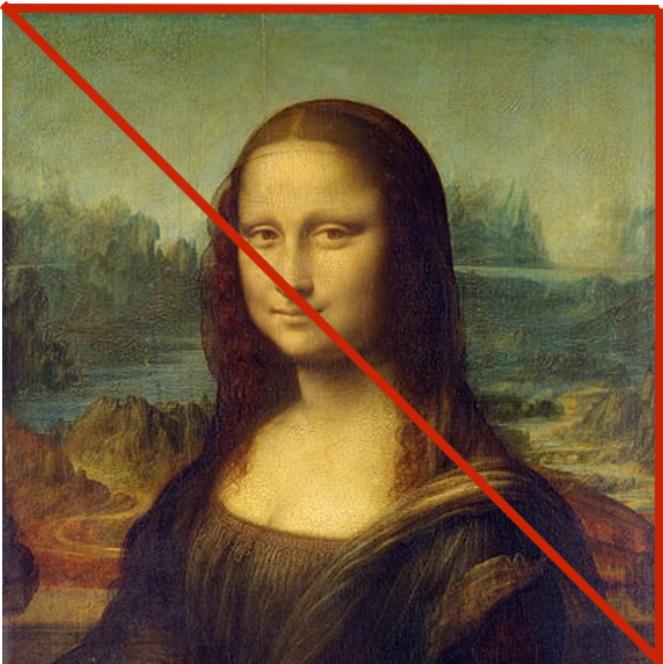
(0,1)

(1,1)



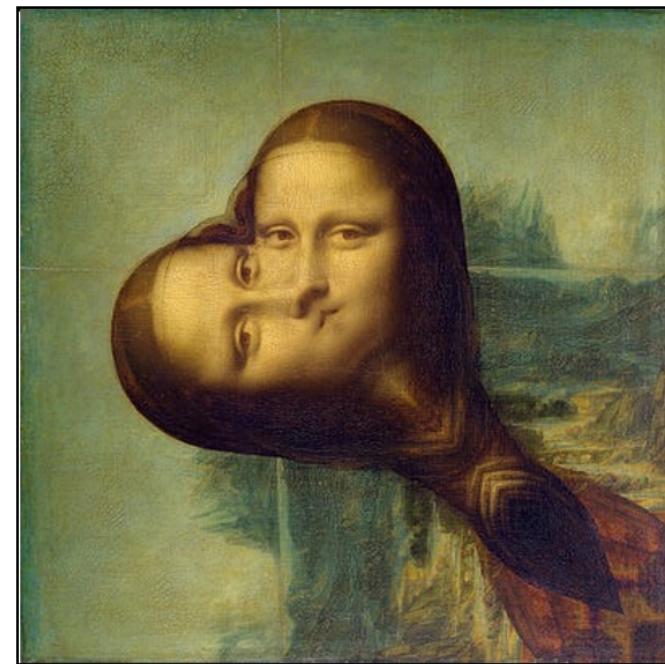


(0,0)



(1,0)

(0,0)



(1,0)

(0,1)

(1,1)

(1,0)

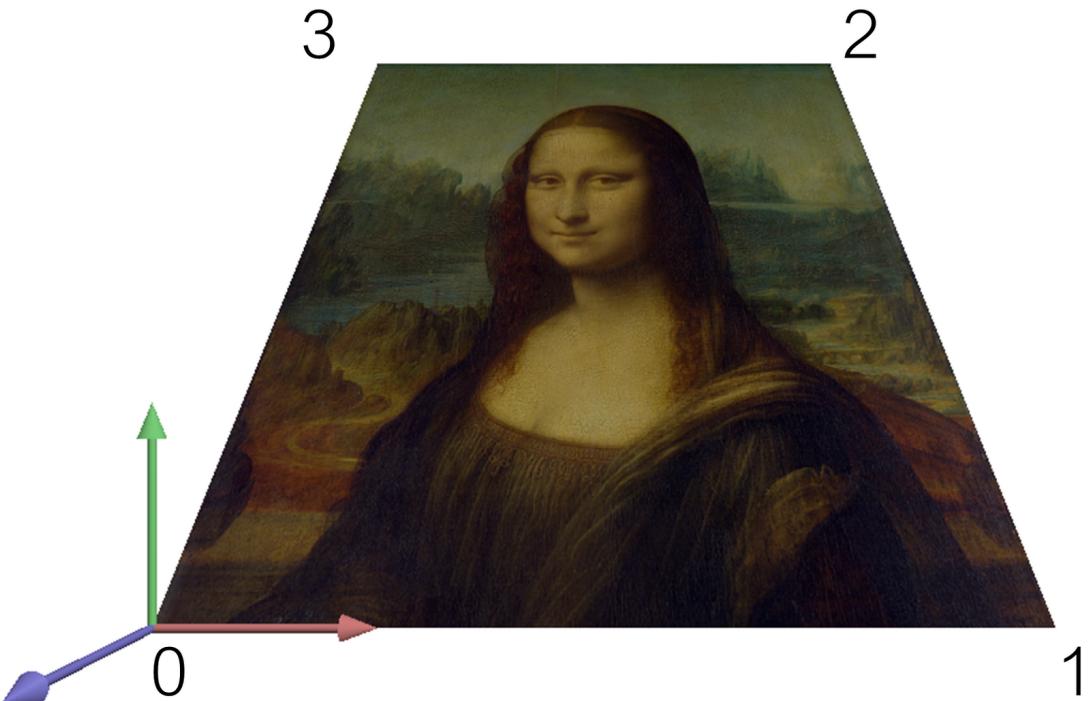
(1,1)

# Example in 3D

0,0

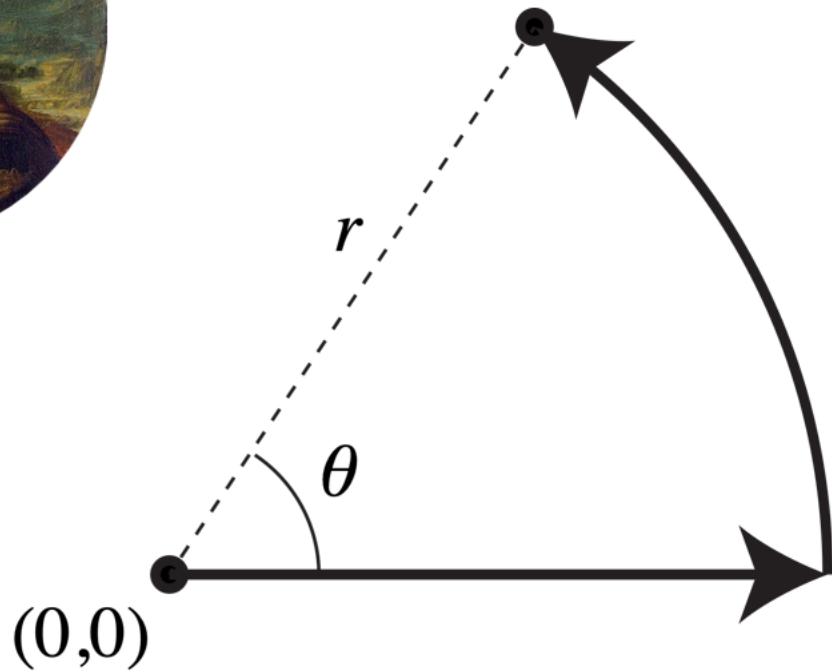


1,1

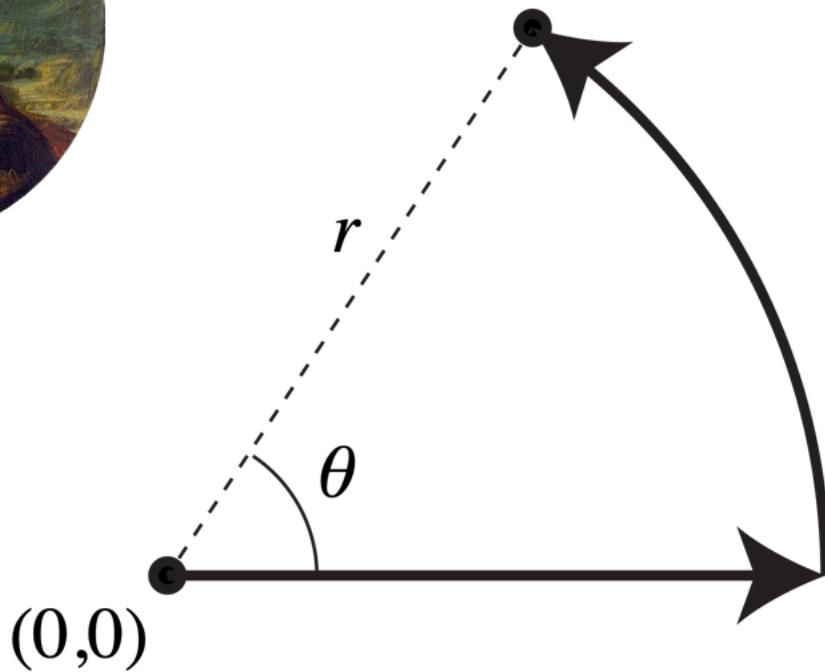


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# Challenge: Draw a Textured Circle



# Challenge: Draw a Textured Circle



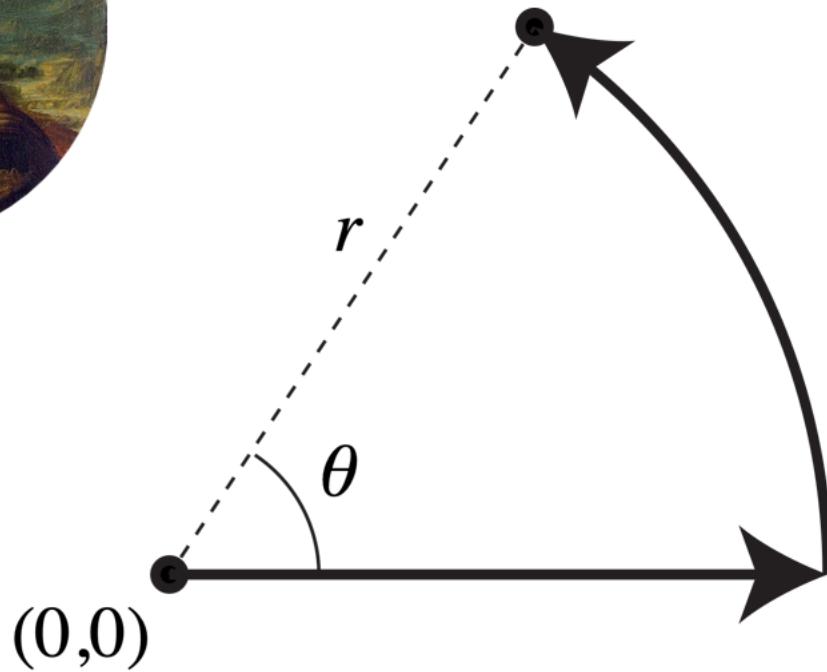
$$x = r \cos(\theta)$$

$$y = r \sin(\theta)$$

$$u = ???$$

$$v = ???$$

# Challenge: Draw a Textured Circle



*Needed to define vertices:*

$$r = 5$$

$$x = r \cos(\theta)$$

$$y = r \sin(\theta)$$

*How to define texture cords?*

$$u = ???$$

$$v = ???$$

# A New Challenge



*Campbell's Soup Cans*  
Andy Warhol, 1968



*Virtual Soup Cans*  
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