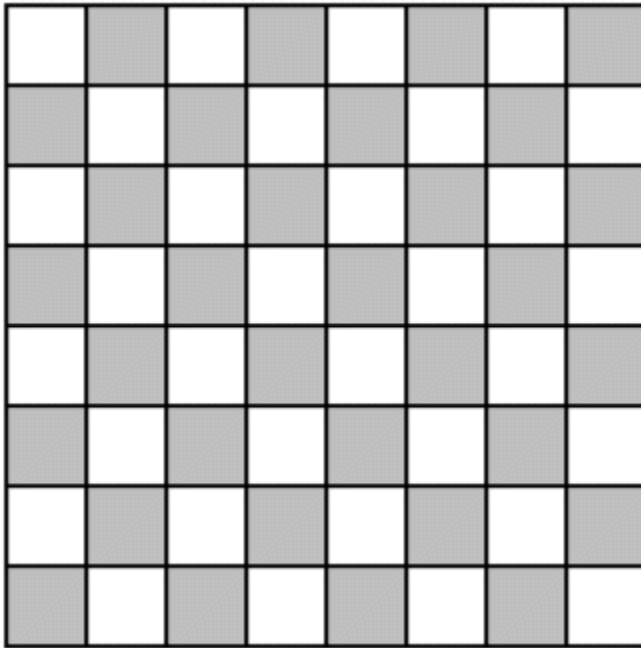


## Texture Filtering

### 1. Magnification

Suppose we have the following 8x8 texture of greyscale values

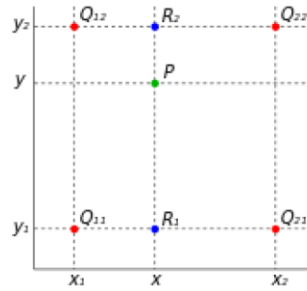


- Texel (0,0) is located in the lower left hand corner.
- White texels have RGB values of (1,1,1)
- Grey texels have RGB values of (0.5, 0.5, 0.5)

Suppose a fragment has (u,v) texture coordinates of (3/4, 19/32).

- a. What fragment color is generated using nearest neighbor?  
Recall that in nearest neighbor filtering you sample the texel (s,t):  
 $s = \text{round}(u \times \text{width} - 1/2)$        $t = \text{round}(v \times \text{height} - 1/2)$

- b. What fragment color is generated using bilinear filtering?  
Recall that bilinear filtering takes the following form:

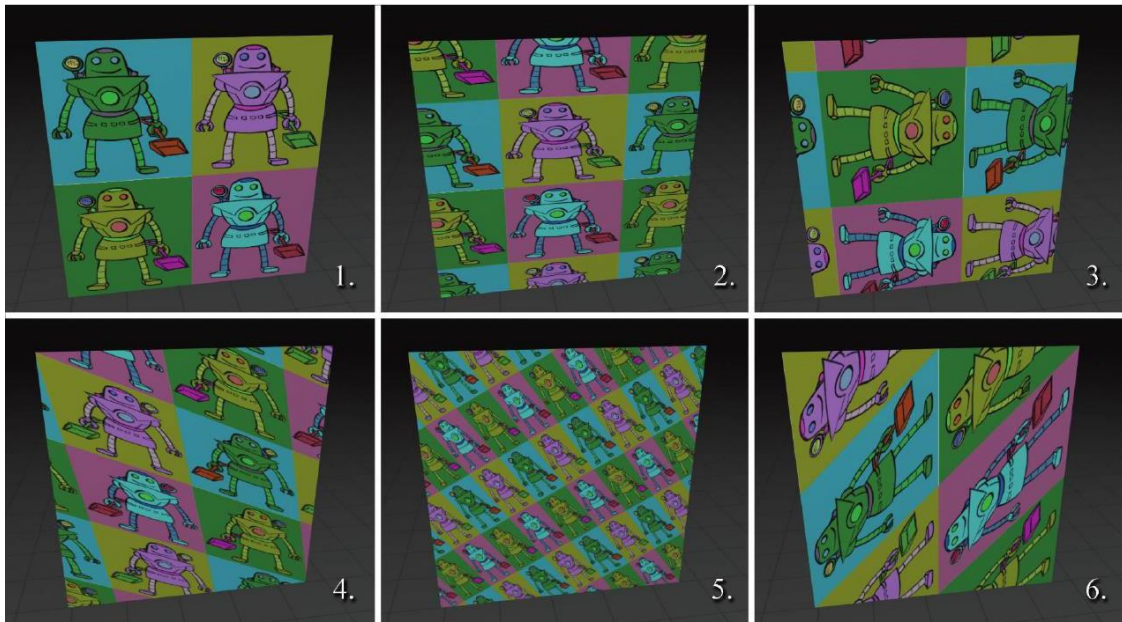


$$f(x, y_1) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{11}) + \frac{x - x_1}{x_2 - x_1} f(Q_{21}),$$

$$f(x, y_2) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{12}) + \frac{x - x_1}{x_2 - x_1} f(Q_{22}).$$

$$f(x, y) \approx \frac{y_2 - y}{y_2 - y_1} f(x, y_1) + \frac{y - y_1}{y_2 - y_1} f(x, y_2)$$

## 2. Texture Coordinates



Match each textured quad above with the set of texture coordinates used to generate it given in the list below. The upper left vertex is number 0 and the vertices are enumerated clockwise around the quad.

- |                       |                    |                  |                   |
|-----------------------|--------------------|------------------|-------------------|
| (a) 0 : (0.20, -0.30) | 1 : (1.30, -0.30)  | 2 : (1.30, 1.20) | 3 : (0.20, 1.20)  |
| (b) 0 : (5.00, -1.00) | 1 : (6.00, -1.00)  | 2 : (6.00, 0.00) | 3 : (5.00, 0.00)  |
| (c) 0 : (1.00, 0.00)  | 1 : (-0.23, -0.77) | 2 : (0.00, 1.00) | 3 : (1.24, 1.77)  |
| (d) 0 : (2.00, 0.00)  | 1 : (1.00, 1.00)   | 2 : (0.00, 1.00) | 3 : (1.00, 0.00)  |
| (e) 0 : (-0.10, 1.10) | 1 : (-0.10, 0.10)  | 2 : (0.90, 0.10) | 3 : (0.90, 1.10)  |
| (f) 0 : (0.00, -1.00) | 1 : (3.35, 0.06)   | 2 : (1.00, 2.00) | 3 : (-2.36, 0.94) |

