6.3000: Signal Processing

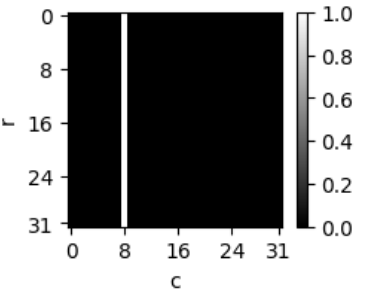
Two-Dimensional DFT

$$F[k_x, k_y] = \frac{1}{N_x N_y} \sum_{n_x=0}^{N_x-1} \sum_{n_y=0}^{N_y-1} f[n_x, n_y]\, e^{-j\left(\frac{2\pi k_x}{N_x} n_x + \frac{2\pi k_y}{N_y} n_y\right)}$$

$$f[n_x, n_y] = \sum_{k_x=0}^{N_x-1} \sum_{k_y=0}^{N_y-1} F[k_x, k_y]\, e^{j\left(\frac{2\pi k_x}{N_x} n_x + \frac{2\pi k_y}{N_y} n_y\right)}$$

Simple Shapes

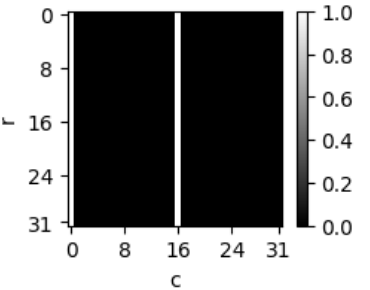
Find the 2D DFT of the following vertical bar.



Array indices in numpy are `[r,c]`, where `r` is row and `c` is column.
The image is 32×32 pixels. The bar is at $c = 8$.

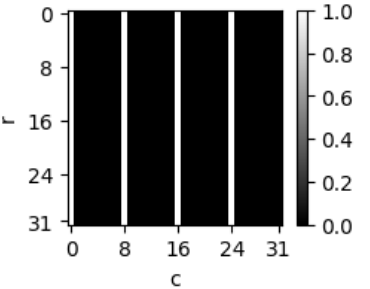
Simple Shapes

Find the 2D DFT of this image, where bars are at $c{=}0$ and $c{=}16$.



Simple Shapes

Find the 2D DFT of the following image.



Simple Shapes

Find the 2D DFT of the following image.