ECGR 6118
Computer Project: image files and 2-D FFT
Student Name:___________

$\text{infile1} := \text{READRGB}(\text{"peppers.gif"})$

Readrgb() reads in an image

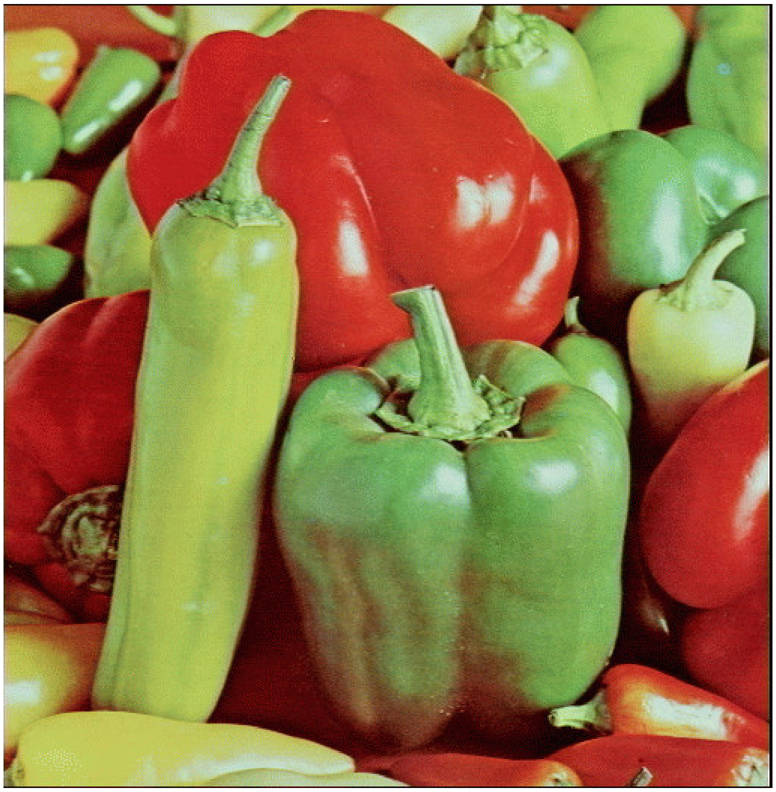
$x := \text{infile1} \quad \text{rows}(x) = 512 \quad \text{cols}(x) = 1.536 \times 10^{3} \quad x_{1,1} = 151$

$$\text{xred} := \text{submatrix}\left(x, 0, \text{rows}(x) - 1, 0, \frac{\text{cols}(x)}{3} - 1\right)$$

$$\text{xgreen} := \text{submatrix}\left(x, 0, \text{rows}(x) - 1, \frac{\text{cols}(x)}{3}, \frac{2\,\text{cols}(x)}{3} - 1\right)$$

$$\text{xblue} := \text{submatrix}\left(x, 0, \text{rows}(x) - 1, \frac{2\,\text{cols}(x)}{3}, \text{cols}(x) - 1\right)$$

Here is how to access each color in the image, as a submatrix of the matrix holding the image data.



Here is how to plot the image (Insert>Image).

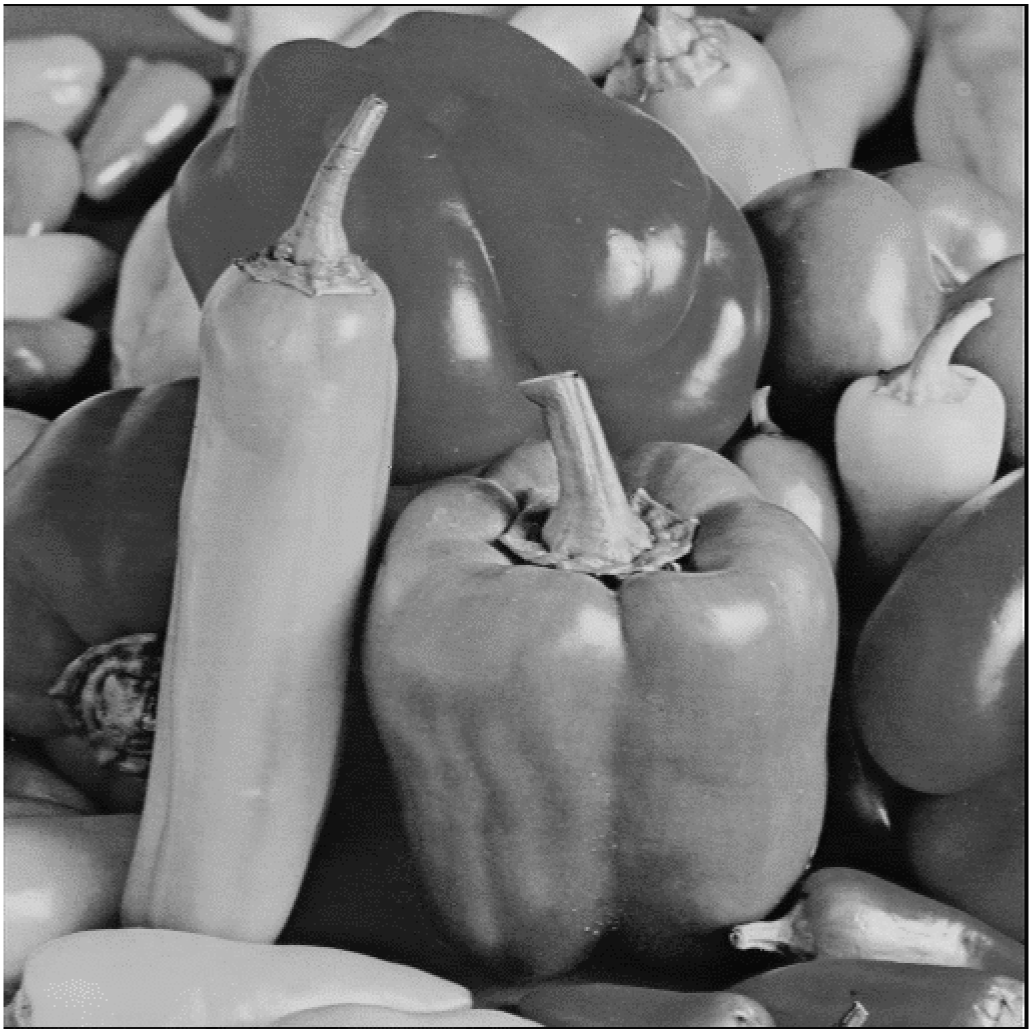
The peppers image is a standard test image from USC-SIPI Image Database at sipi.usc.edu/database/

Readbmp() allows you to read in an image and force it to a grayscale image, even if the original image was color.

infile2 := READBMP("peppers.gif")

x := infile2

rows(x) = 512 cols(x) = 512 $x_{1,1} = 105$



$xac := x - \text{mean}(x)$

$XX := \text{CFFT}(xac)$

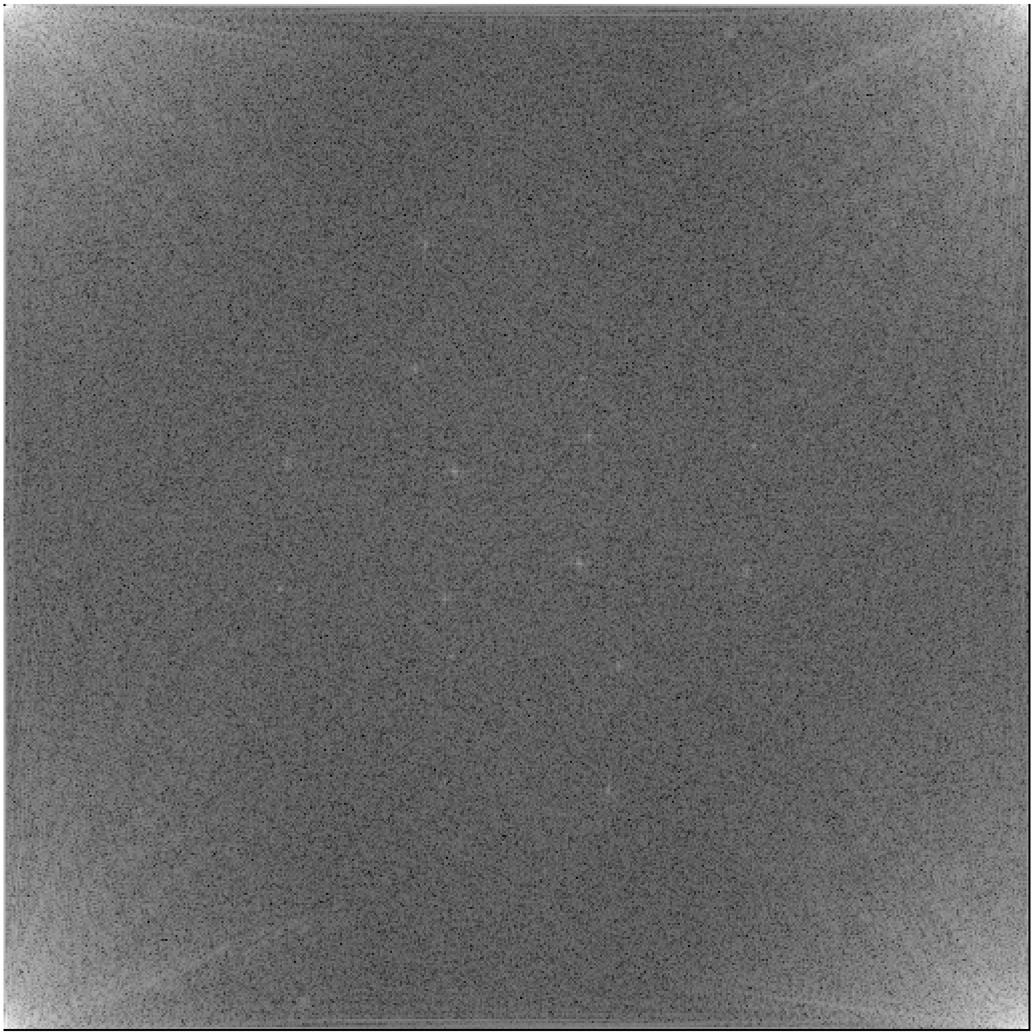
$XX := \overrightarrow{50 \cdot \log(|10000XX| + 0.000001)}$ $\max(XX) = 249.017$

A simple fast Fourier transform of the image using the CFFT() function, then rescaling the magnitude to lie between gray levels 0->255.

(Dont forget to prevent errors from taking log(0).)

$rr := 0 .. \text{rows}(XX)$ $cc := 0 .. \text{cols}(XX)$

$XX_{rr,cc} := \text{if}\left(XX_{rr,cc} < 0, 0, \text{floor}\left(XX_{rr,cc}\right)\right)$ $\max(XX) = 249$



You can create your own function to print a more elaborate Fourier transform

```
$\mathrm{logmagfreq}(x) :=$
    $rr \leftarrow \mathrm{rows}(x) - 1$
    $cc \leftarrow \mathrm{cols}(x) - 1$
    $mean \leftarrow 0$
    $mean \leftarrow \mathrm{mean}(x)$
    $x2 \leftarrow x - mean$
    for $r \in 0..rr$
        for $c \in 0..cc$
            $x3_{r,c} \leftarrow x2_{r,c} \cdot (-1)^{r+c}$
    $fx \leftarrow \mathrm{CFFT}(x3)$
    $magfx \leftarrow \overrightarrow{|fx|}$
    $maxmag \leftarrow \max(magfx)$
    $magfx \leftarrow magfx + \frac{maxmag}{100000000}$
    $logmagfx \leftarrow 3 \cdot \overrightarrow{\left(20 \cdot \log\left(\frac{10000 \cdot magfx}{maxmag}\right)\right)}$
    for $r \in 0..rr$
        for $c \in 0..cc$
            $x4_{r,c} \leftarrow \mathrm{floor}\left(\max\left(logmagfx_{r,c}, 0\right)\right)$
    for $ll \in 0..3$
        for $r \in 0..10$
            for $c \in 0..10$
                $x4_{r+10 \cdot ll, c} \leftarrow \mathrm{if}(c = 10, 250, 240 - 60 \cdot ll)$
    $x4$
```

remove mean from image before taking transform

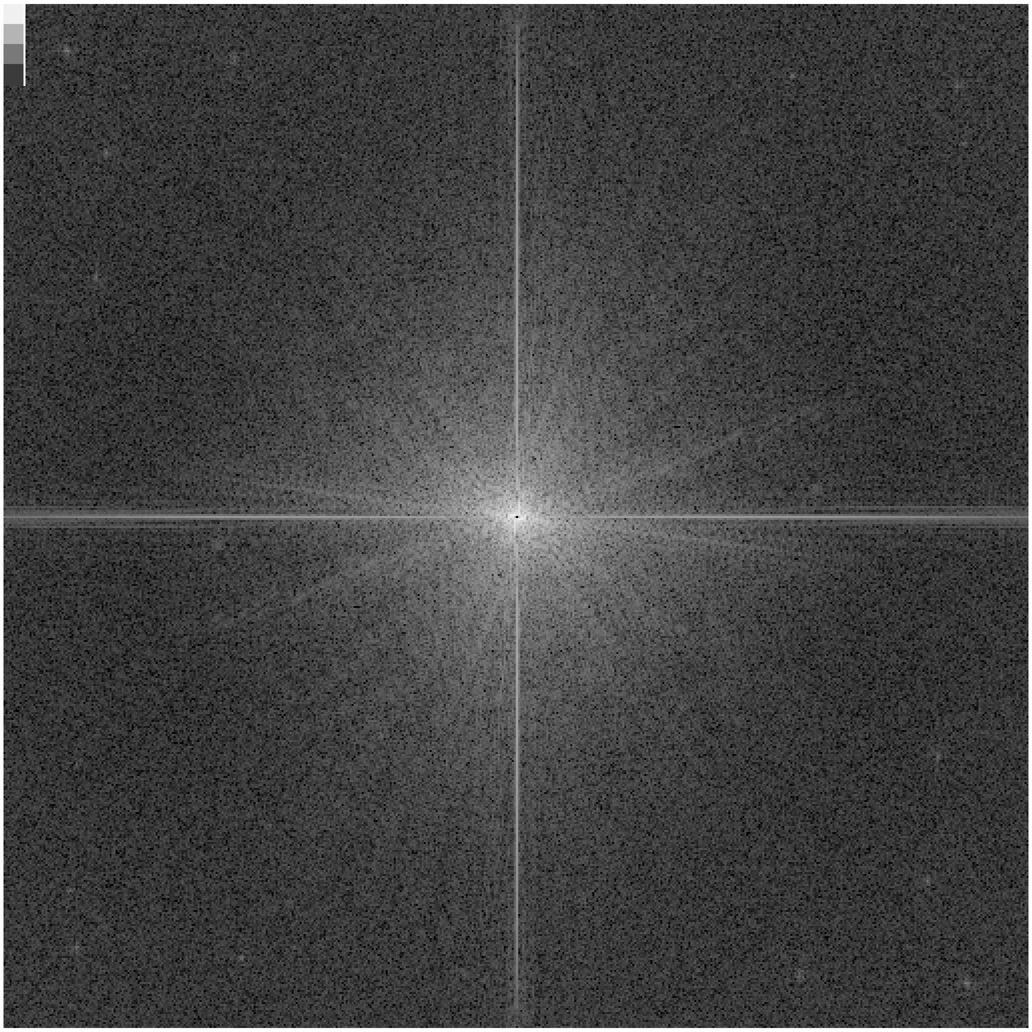
multiply by (-1)^(r+c) to center the Fourier spectrum

make sure magfx never equals zero before taking log()

fftx := logmagfreq(x)

max(fftx) = 250

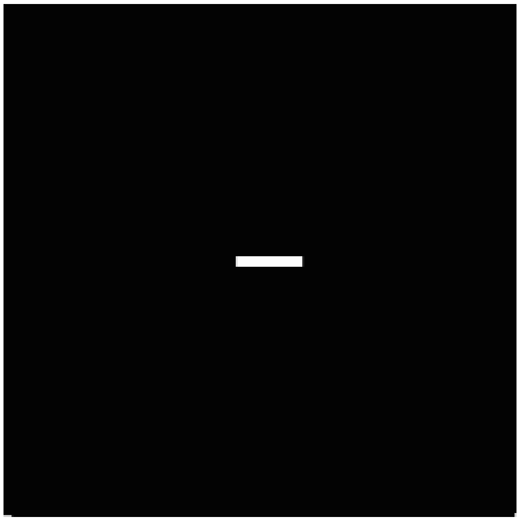
min(fftx) = 0



infile2 := READBMP("rect5.gif")

x := infile2

rows(x) = 256   cols(x) = 256 $x_{1,1} = 3$



fftx := logmagfreq(x)

max(fftx) = 250   min(fftx) = 0