1 Matlab functions

1.1 ScaleFTAmp.m

function FAmp = ScaleFTAmp(F)
% shift the FT with shift, log, and rescale

c = 4.;

% take the log of the amplitude
FAmp = log10(abs(F)/max(max(abs(F))) + 0.000001);

% normalize the max number to 255
FAmp = (FAmp + c) * 255 / c;
FAmp = fftshift(FAmp);

1.2 ReduceFT.m

function out = ReduceFT(in, range)
% reduce the FT coefficients to only those chosen
% around DC
[x_size, y_size] = size(in);
out = in;
out(range + 1 : x_size - range, :) = 0.0001;
out(:, range + 1 : x_size - range) = 0.0001;

2 Results

2.1 Task a

Typing
im = imread('ca2.tif');
imagesc(im); colormap(gray);
axis square;
yields the result in Figure 1.
Typing

```matlab
ft = fft2(im);
sft = ScaleFTAmp(ft);
imagesc(sft); colormap(gray);
axis square;
```

yields the result in Figure 2.
2.2 Task b: Reduced to [-128:127]

Typing

```matlab
ft_128 = ReduceFT(ft, 128);
sft_128 = ScaleFTAmp(ft_128);
imagesc(sft_128); colormap(gray);
axis square;
```
yields the result in Figure 3.
Figure 3 FT coefficients magnitude, reduced to [-128:127]

Typing
```matlab
im_128 = real(ifft2(ft_128));
imagesc(im_128);
axis square;
PSNR(im, im_128)
```
yields the result in Figure 4 and a PSNR = 31.2383.
2.3 **Task c Reduce to [-64:63]**

Typing

```matlab
ft_64  = ReduceFT(ft, 64);
sft_64 = ScaleFTAmp(ft_64);
imagesc(sft_64); colormap(gray);
axis square;
yields the result in Figure 5.
```
Typing
\[
\text{im}_64 = \text{real}(\text{ifft2}(\text{ft}_64));
\]
\[
\text{imagesc}(\text{im}_64);
\]
\[
\text{axis square};
\]
\[
\text{PSNR}(\text{im}, \text{im}_64)
\]
yields the result in Figure 6 and a PSNR = 26.7170.
2.4 Task c Reduce to [-32:31]

Typing

```matlab
ft_32 = ReduceFT(ft, 32);
sft_32 = ScaleFTAmplitude(ft_32);
imagesc(sft_32); colormap(gray);
axis square;
```
yields the result in Figure 7.
Figure 7 FT coefficients magnitude, reduced to [-32:31]

Typing

```
im_32 = real(ifft2(ft_32));
imagesc(im_32);
axis square;
PSNR(im, im_32)
```
yields the result in Figure 8 and a PSNR = 24.1756.
Figure 8 Bridge, reconstructed from [-32:31]