CS4640 Quiz 4 Spring 2018

Name:

1. Graph the following 1D functions and their Fourier transform pair function.

1a. box function

1b. sinc function

2. Convolve the 4-neighbor Laplacian 3x3 filter with the given image, and show the value at every pixel in the output (assume zero-padding).

im

```
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 1 1 1 0 0
0 0 1 1 1 0 0
0 0 1 1 1 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
```

filter

```
0 1 0
1 -4 1
0 1 0
```

convolved result

```
0  0  0  0  0  0  0
0  0  1  1  1  0  0
0  1 -2 -1 -2  1  0
0  1 -1  0 -1  1  0
0  1 -2 -1 -2  1  0
0  0  1  1  1  0  0
0  0  0  0  0  0  0
```

3. Explain how subtracting the Laplacian of an image from the image will sharpen edges. In particular, give the details of line 4 of the image in problem 2 to demonstrate this.

An edge profile is like 

the Laplacian there is like 

So subtracting the two: 

makes the lower side of the edge even lower and the high side higher increasing the contrast

From 2:

im:	0	0	1	1	1	0	0
Laplacian:	0	1	-1	0	-1	1	0
subtracting	0	-1	2	1	2	-1	0

4. Write a Matlab function to create an MxN binary image of a circle with center (r_0, c_0), and radius *radius* (see header).

```
function im = CS4640_make_circle(M,N,r0,c0,radius)
% CS4640_make_circle - make a circle in an image
% On input:
%     M (int): number of rows
%     N (int): number of cols
%     r0 (int): row of circle center
%     c0 (int): col of circle center
%     radius (double): radius of circle
% On output:
%     im (MxN binary image): with circle centered at (r0,c0)
% Call:
%     cir21 = CS4640_make_circle(101,101,51,51,21);
% Author:
%     T. Hendrerson
%     UU
%     Spring 2018
%
```

```
im = zeros(M,N);

for r = 1:M
    for c = 1:M
        if (r-r0)^2 + (c-c0)^2 <= radius^2
            im(r,c) = 1;
        end
    end
end
```