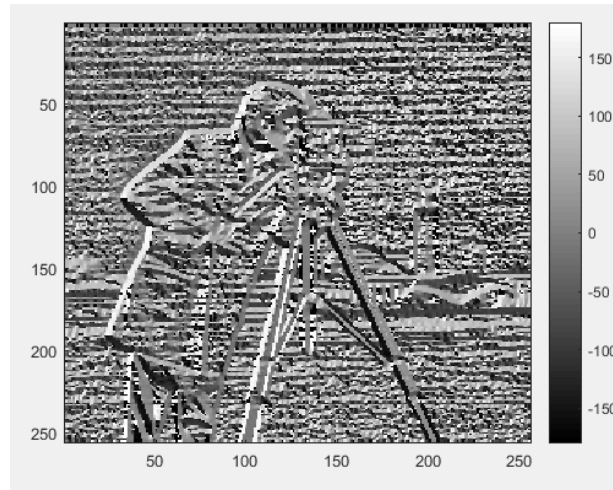


# Problem 1

## Problem 1)

To calculate the Gradient of image we have to find central difference  $[-1 \ 0 \ 1]$  which is the derivative of an image with respect to x and y then calculate  $\text{Angle} = \tan^{-1}(dx/dy)$ . There is built in function in matlab that help us to do so. Here is the image that shows the angle 180 to -180. Beside the image there is a color bar that represent angles.

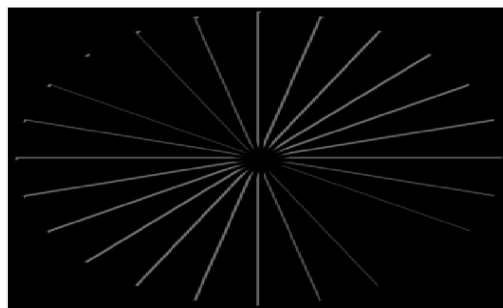


## Problem 2)

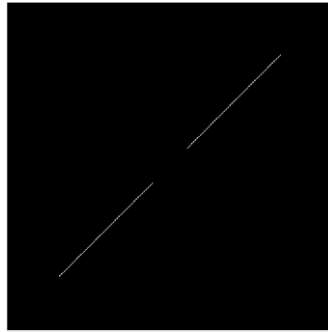
Simple sobel 3x3 filter is used to detect vertical or horizontal lines. If we rotate filter it will be able to detect all the lines that are at 45 degrees. Furthermore, to normalize the image we can divide it by 8. As absolute sum of all integer

$-2/8$	$-1/8$	0
$-1/8$	0	$1/8$
0	$1/8$	$2/8$

After applying convoultion on Line image we get the following image



As this filter return high value at 45 and low value at all other angles. So, I get the max value of image that is 127. So I apply the threshold between 126 and 127. I get the following image.



### Problem 3)

After applying given filter  $F = [1 \ 0 \ -1]$  to cameraman image we get the following result.



We cannot retrieve original image after applying convolution:

Consider the following sincro

**Image A**

5	0	5
7	0	7
8	0	8

**Convolve**

0	0	0
0	0	0
0	0	0

Proof:

$$Y_n = X_{n-1} - X_{n+1} \Rightarrow Y_n = 5 - 5 \Rightarrow Y_n = 0$$

$$Y_n = X_{n-1} - X_{n+1} \Rightarrow Y_n = 7 - 7 \Rightarrow Y_n = 0$$

$$Y_n = X_{n-1} - X_{n+1} \Rightarrow Y_n = 8 - 8 \Rightarrow Y_n = 0$$

Hence, there is no way to get back original image from 0 because any 3x3 filter provide matrix of 0 image.

How to run code:

- 1) Extract the zip code file.
- 2) Run matlab
- 3) Change current working directory of matlab to extracted file
- 4) Press P1\_1L164309 , P1\_2L164309 , P1\_3L164309 respective to get the output of the image

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