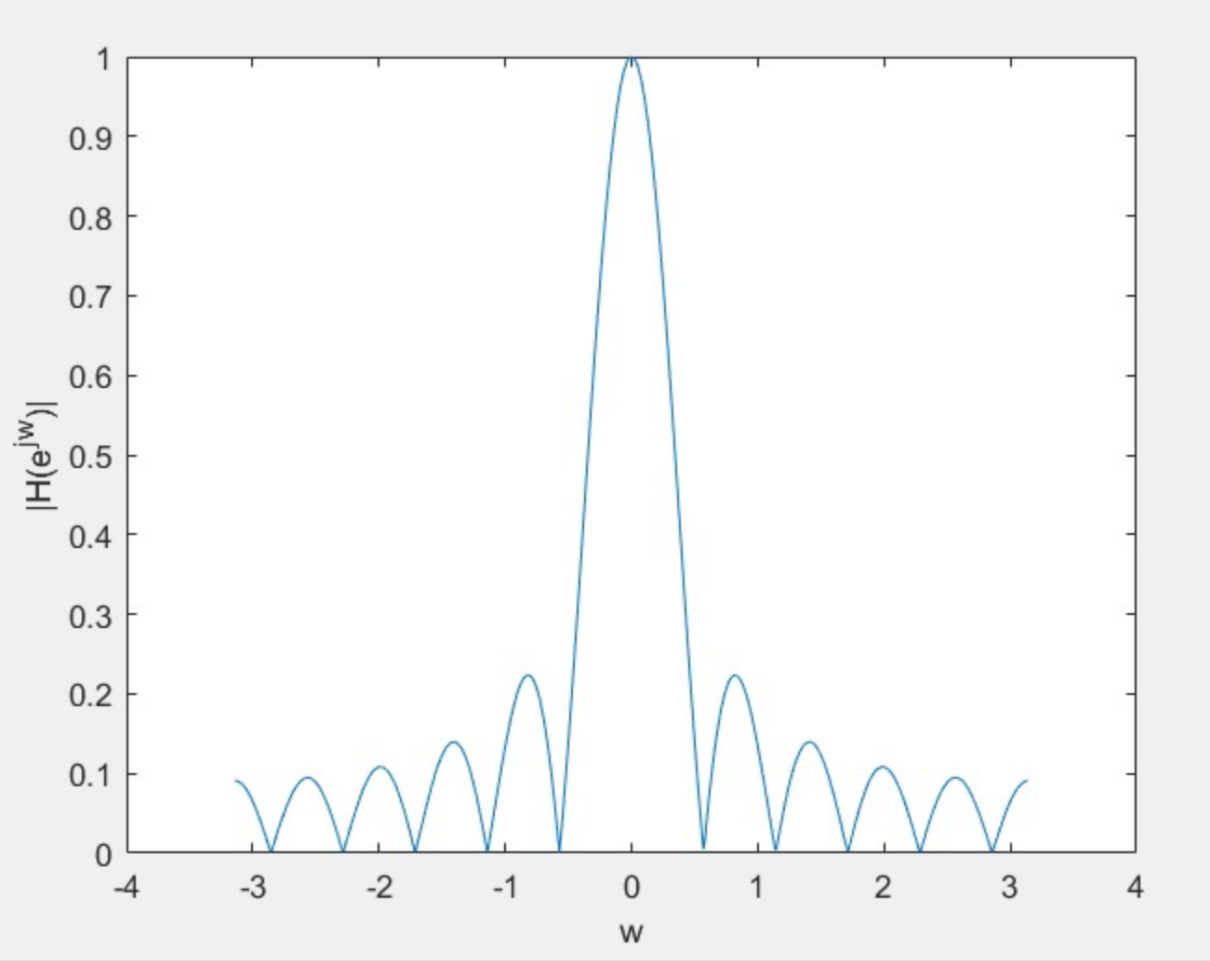
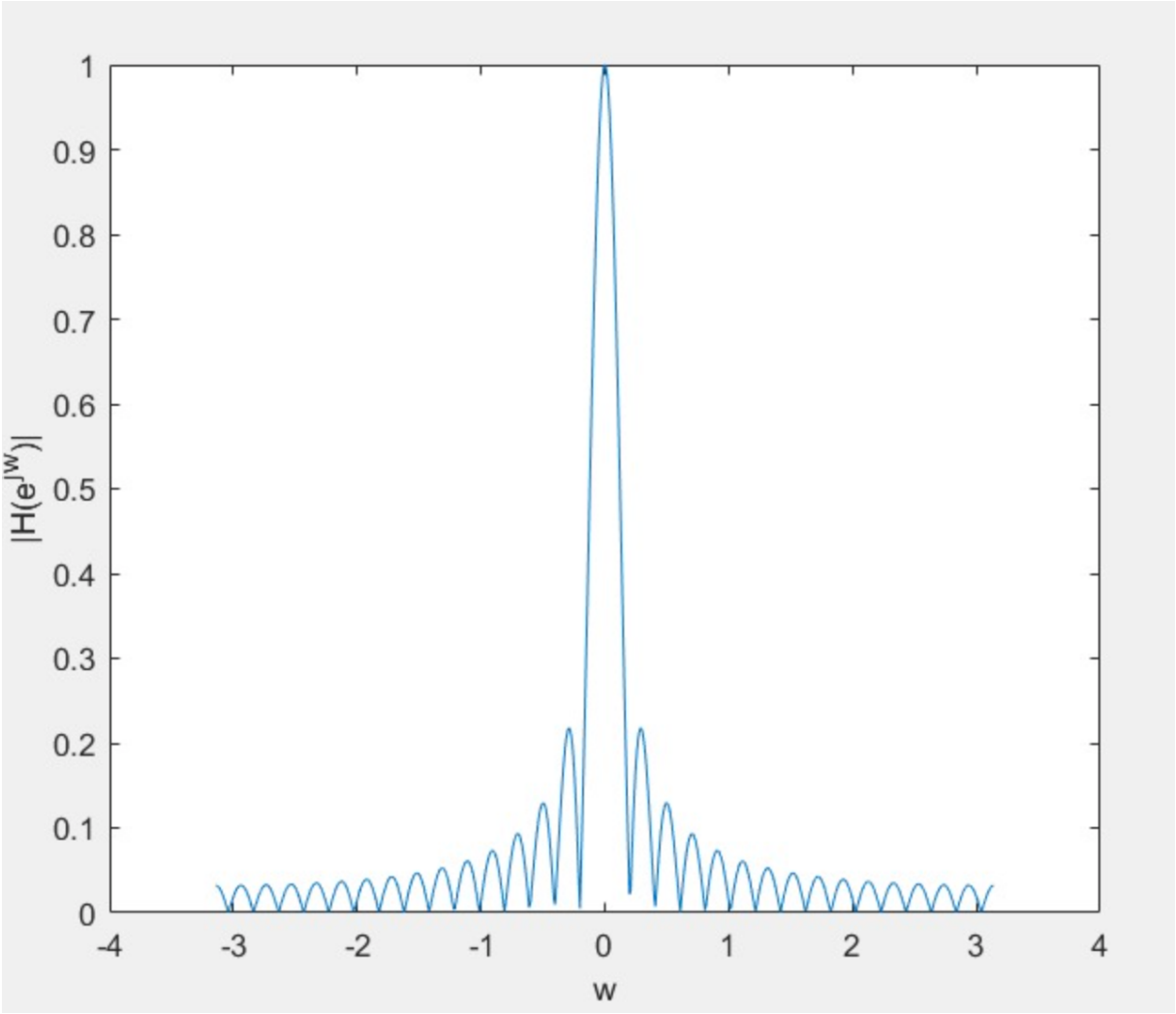
Filtered image, M = 11

Magnitude of Filter response function, M = 11



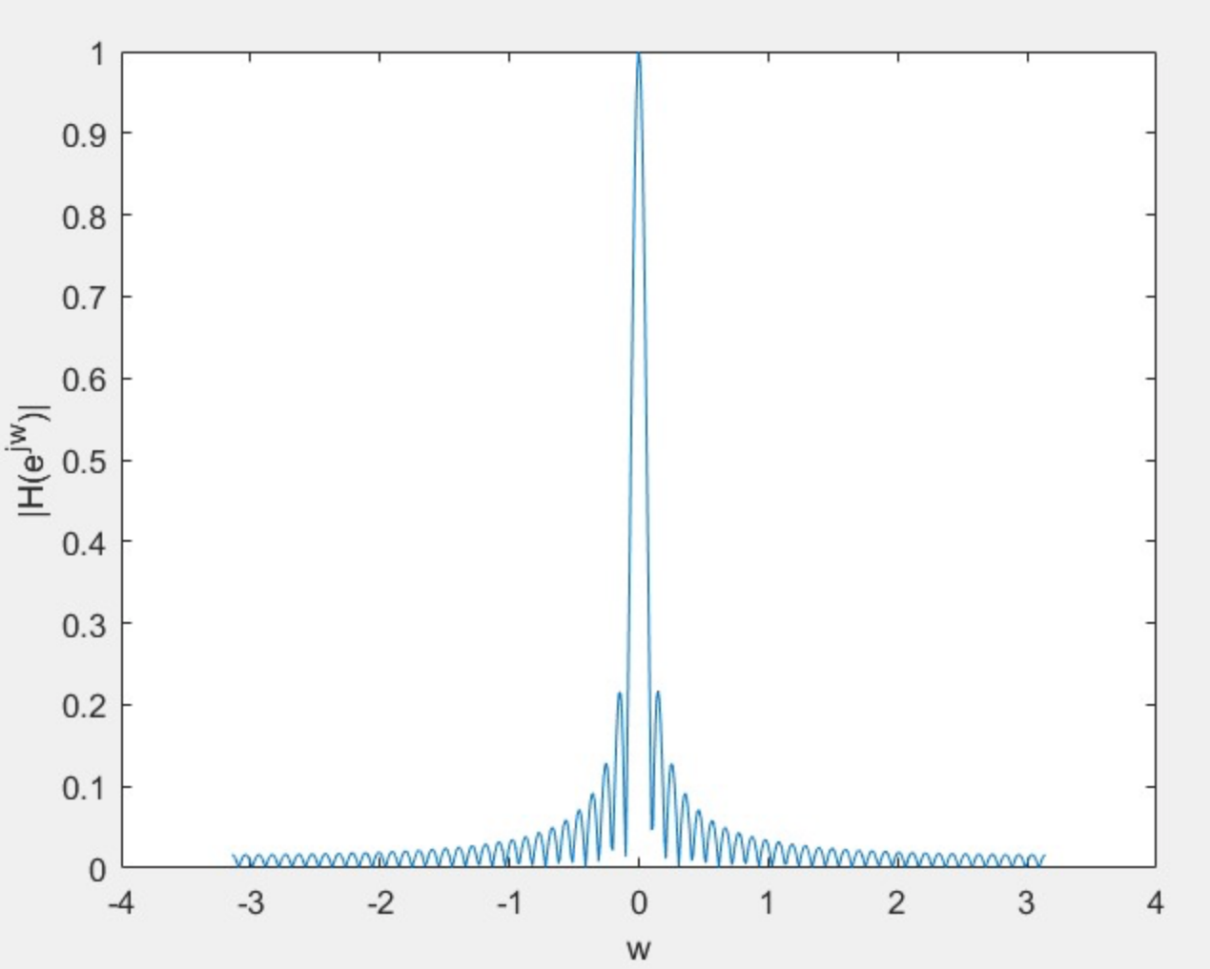
Filtered Image, M = 31

Magnitude of Filter response function, M = 31



Filtered Image, M = 61

Magnitude of Filter response function, M = 61



1)

i)

The filter made the image blurry.

ii)

The details in the filtered image disappear because of the blur effect.

iii)

The image is blurred to left and right. The blur effect of the filter is horizontal. There is no effect in vertical axis.

iv)

The effect of the filter function is as the filter response graphs. Different frequency components of the image are changed according to the y-values of these graphs. The frequency of these graphs increase as M increases

v)

The left and right edges are black because during the averaging process, the values outside the image are considered to be 0.

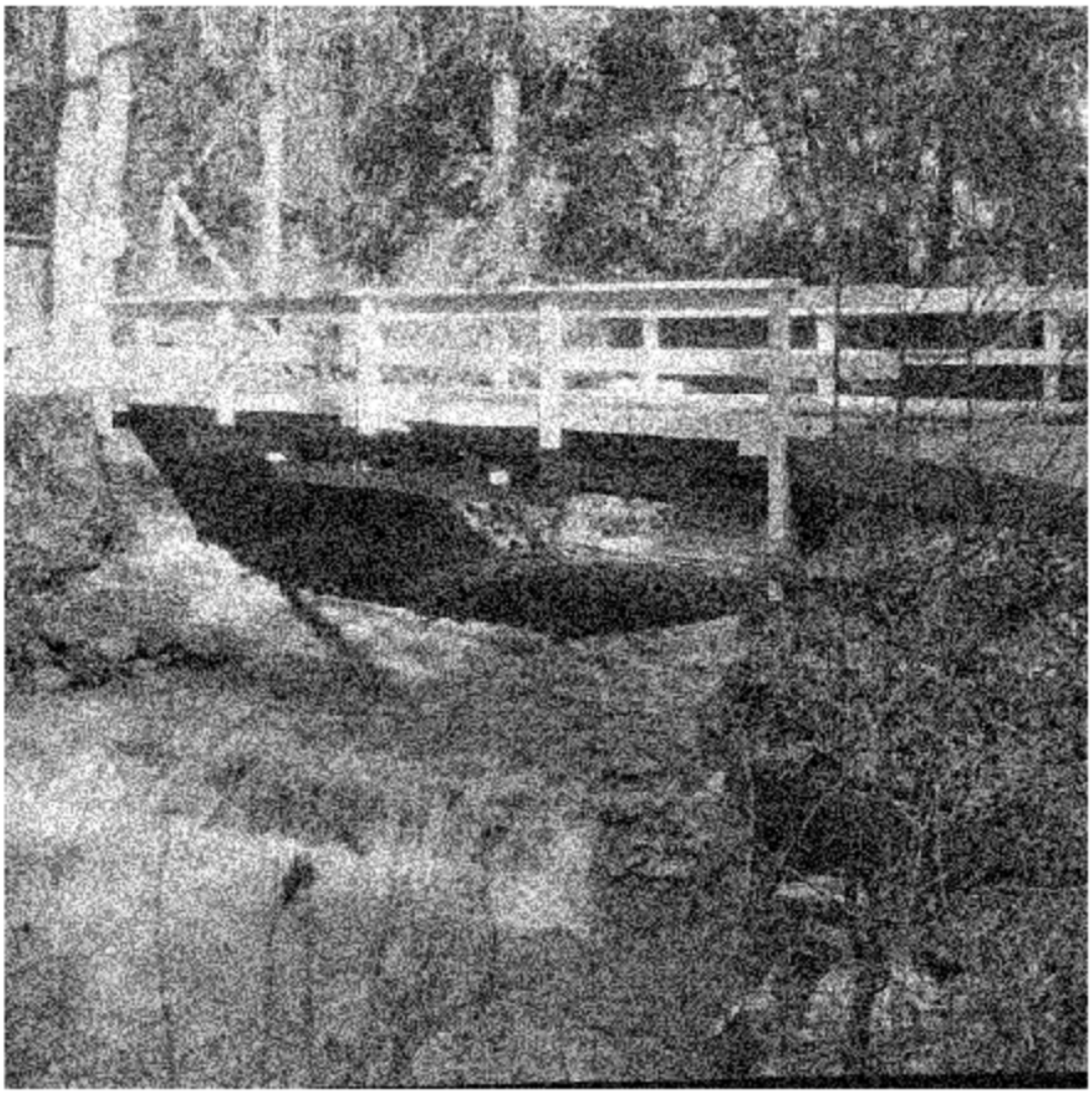
Noise c = 0.2

C = 0.2, M = 11:

C = 0.2, M = 31:

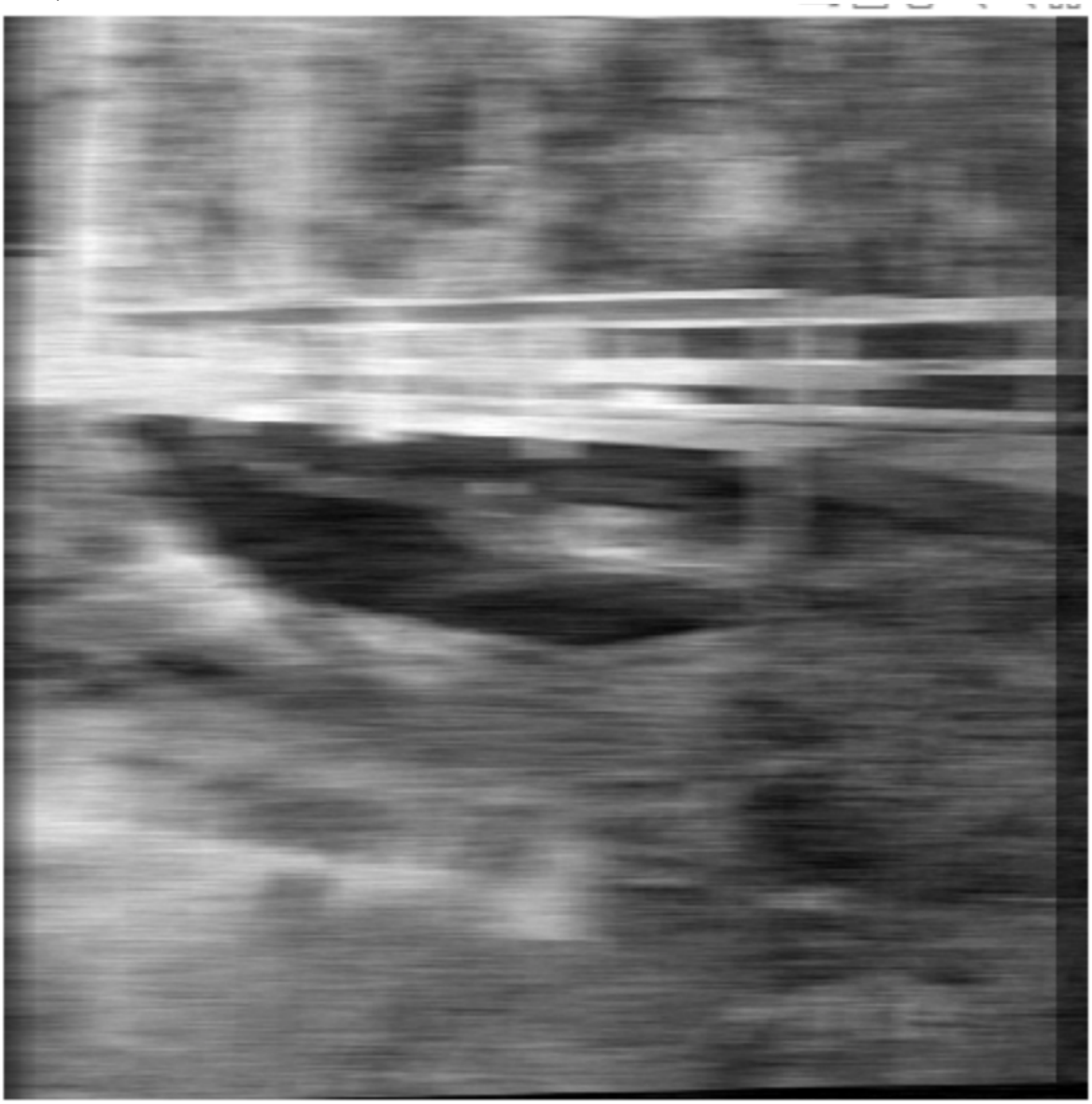
C = 0.2, M = 61

Noise c = 1



C = 1, M = 11

C = 1, M = 31

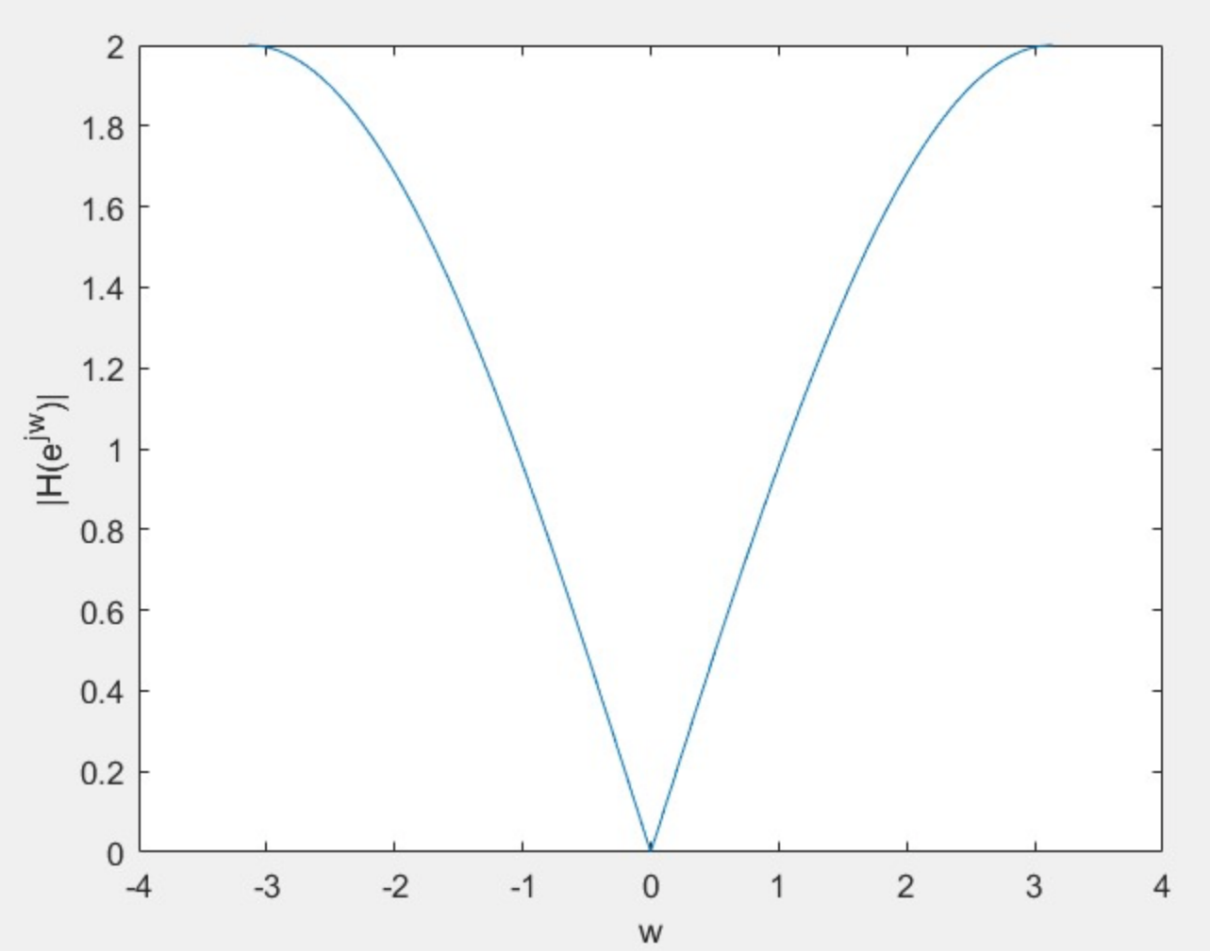


C = 1, M = 61

vi)
Yes, averaging helps reduce the noise. As the value of M increases, the noise reduction becomes more effective.
vii)
Yes, the side effect is that averaging makes the image blurry. This side effect increases as M increases.
viii)
M=11 is the best choice of M.
2)

Filtered Image

Magnitude of Filter response function



i)

With this filter the boundaries of the objects are the only visible elements. These boundaries are white, other parts of the image are black.

ii)

In the filter function, the values of the resulting matrix are set as the difference of the two adjacent pixels. Therefore the result of this filter was the same as my theoretical expectations.

17.1

iii)

The effect is on the horizontal axis, there is no effect on vertical axis. However, since this only involves two pixels, it does not have a clear visual effect difference between the two axis.

17.2

iv)

The magnitude is 0 when frequency is 0. This filter affects different frequencies according to the graph above.

Index of comments

1.1 Q1) 45 / 50

Q2) 40 / 50

7.1

-5 Need to specify this is a Low Pass Filter, as M increases cut-off frequency decreases which eliminates high frequencies

17.1 -5 Theoretically it is HPF and we observe this behavior

17.2 -5 filter sharpens the vertical lines/details in image, as a result of filter working in horizontal direction