

## Lab 2. Task 1- preparation task

### Template for answers

**Save this document as a .pdf document before submitting.**

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*Submission date: 21-11-23*

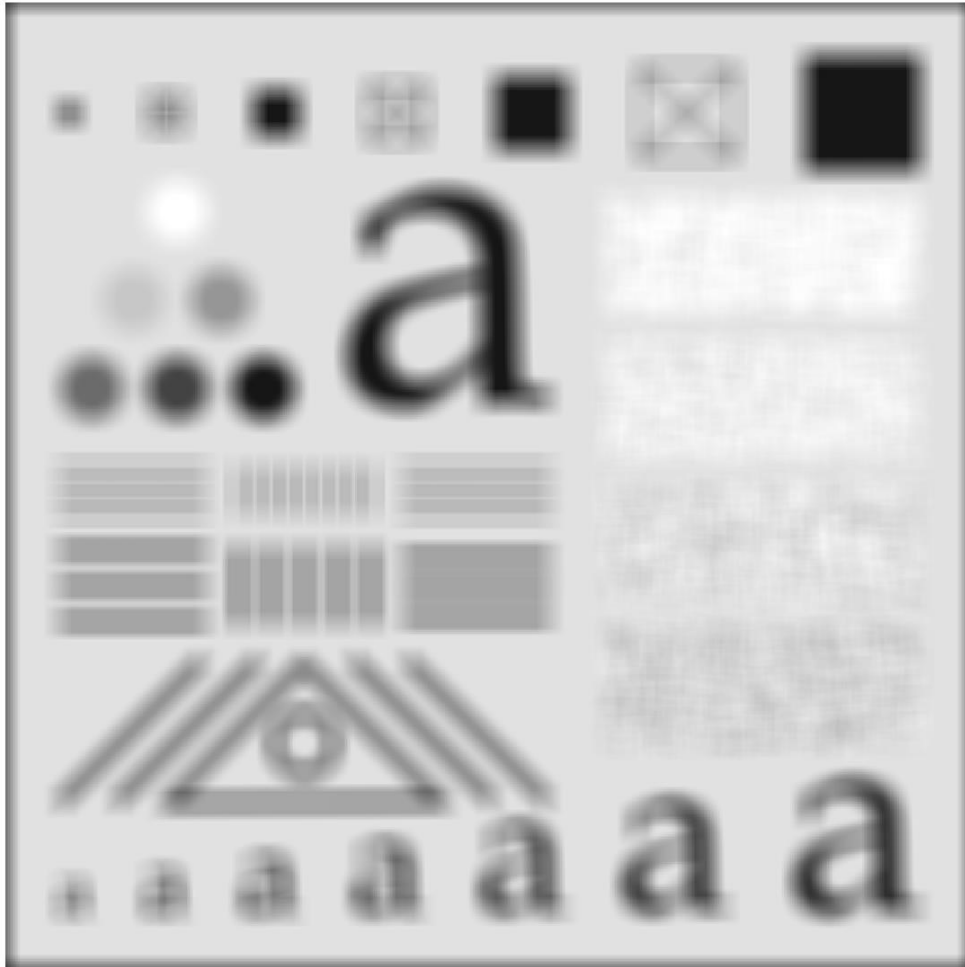
*Version (in case you need to re-submit): 2*

### 1) Testing different box filters

**1)** Image1:



**2)** Image2:



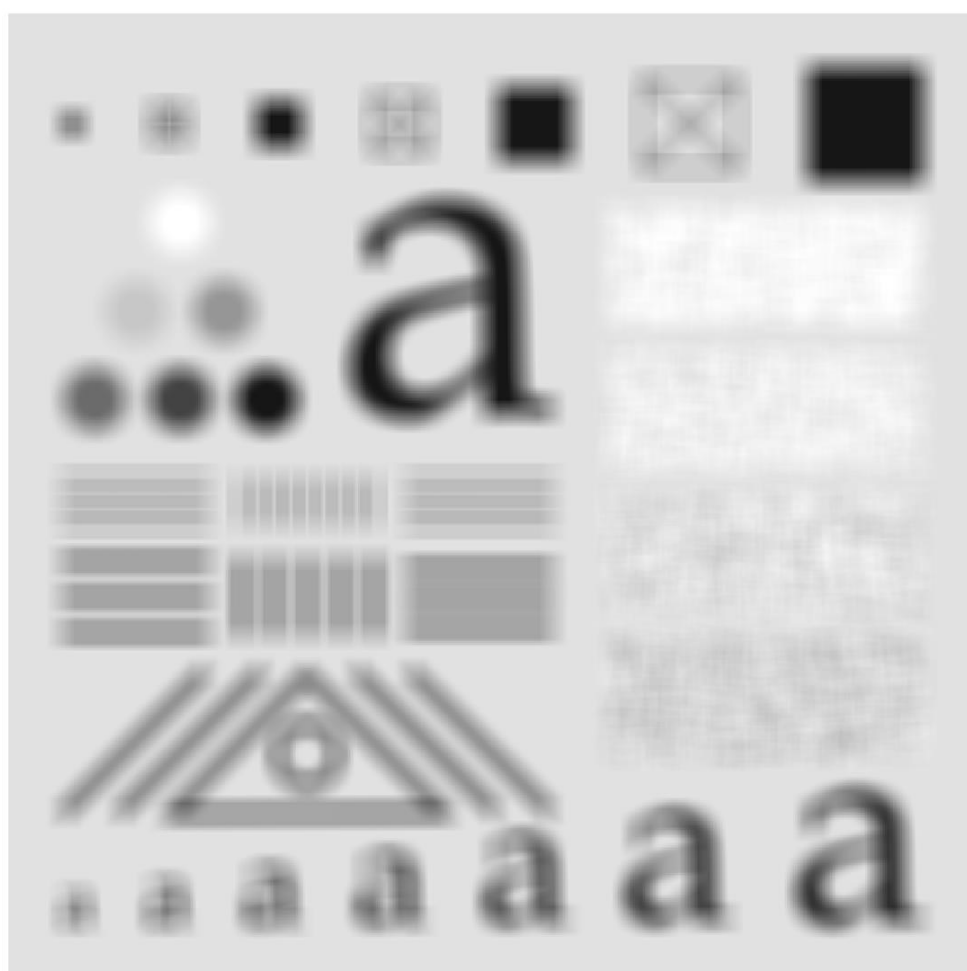
**3)** Does the  $21 \times 21$  box filter have a lower or higher cutoff frequency than the  $9 \times 9$  box filter? Explain why!

When we increased the box filter to  $21 \times 21$  we received a more blurred image. Therefore the  $21 \times 21$  box filter has a lower cutoff frequency and that is because it eliminates more of the higher frequencies. The image loses more information.

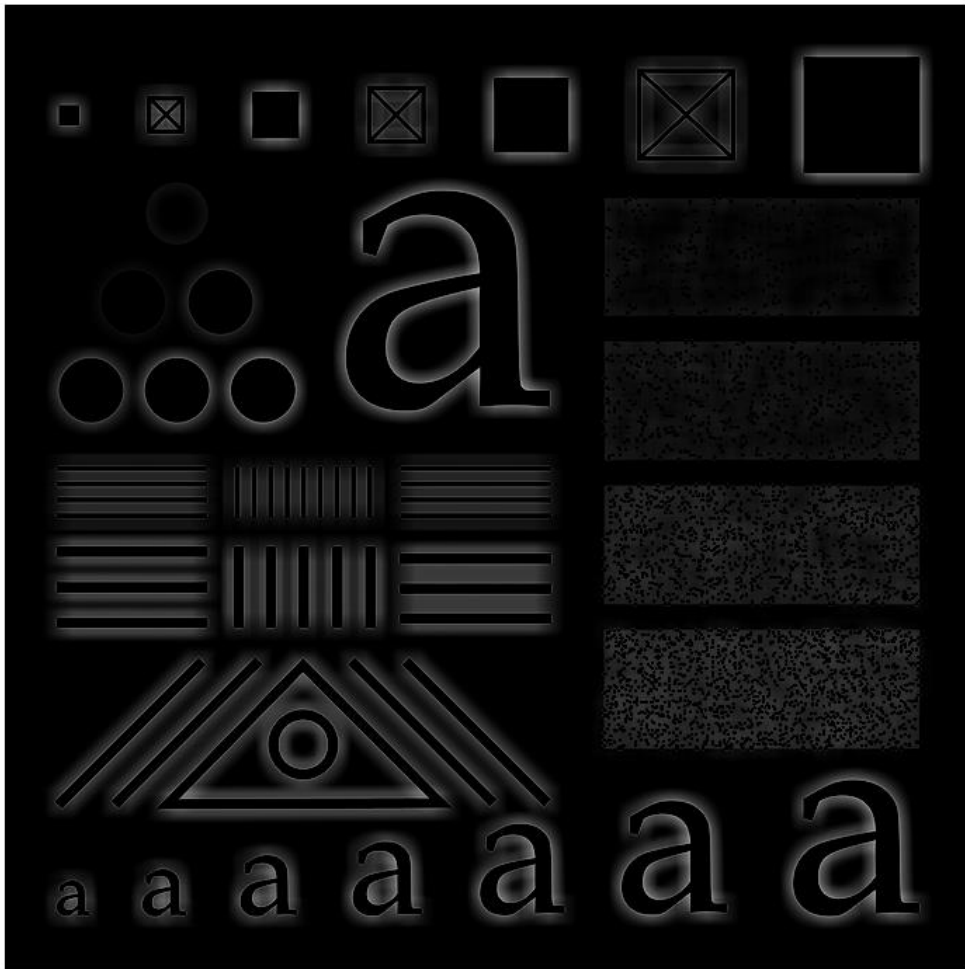
**4)** What is the reason for these dark borders in Image2?

Because we have a zero padding. The `imfilter` function fills the pixels on the edge with black because they have the pixel value = 0. The size of the dark border depends on the size and type of the filter kernel used.

**5)** Image3:



6) Image4:

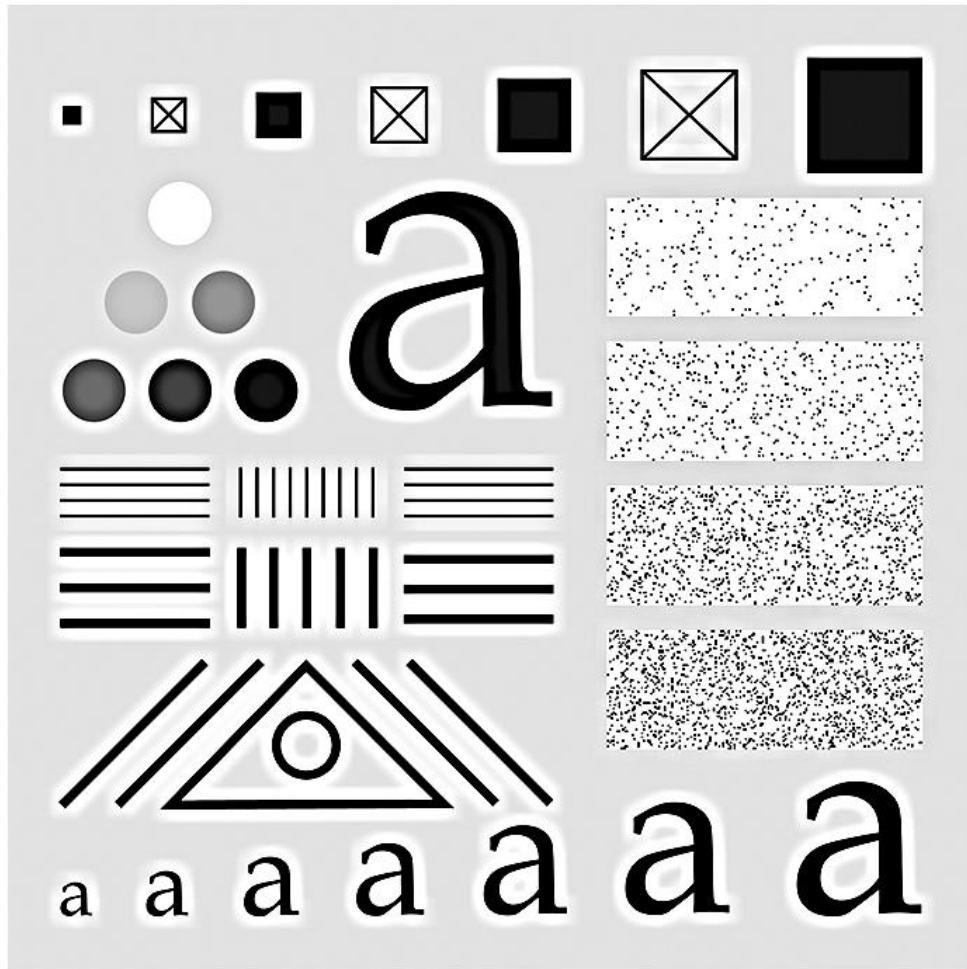


7) Why is *Image4* so dark? What is the average value of the pixel values in *Image4*? And why?

The image is dark because most of the pixels has a negative value. Because it is a highpass filter only the high frequencies get trough and the low frequencies are rejected.

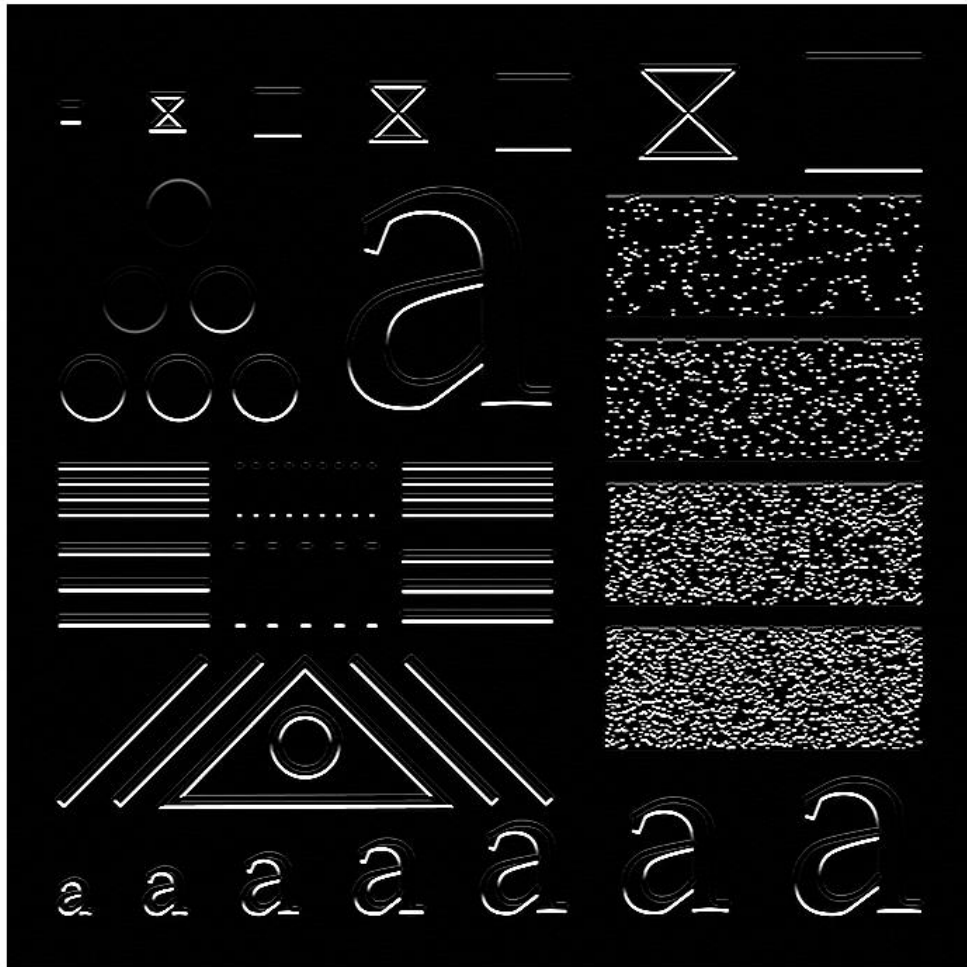
Because we are subtracting a lowpass function from 1 (mean value) we get negative values. A highpass filter kernel is obtained by subtracting a lowpass filter kernel from a unit impulse with the same center as the kernel. Because they have the same center the mean value will become zero when subtracting the lowpass filter.

8) Image5:

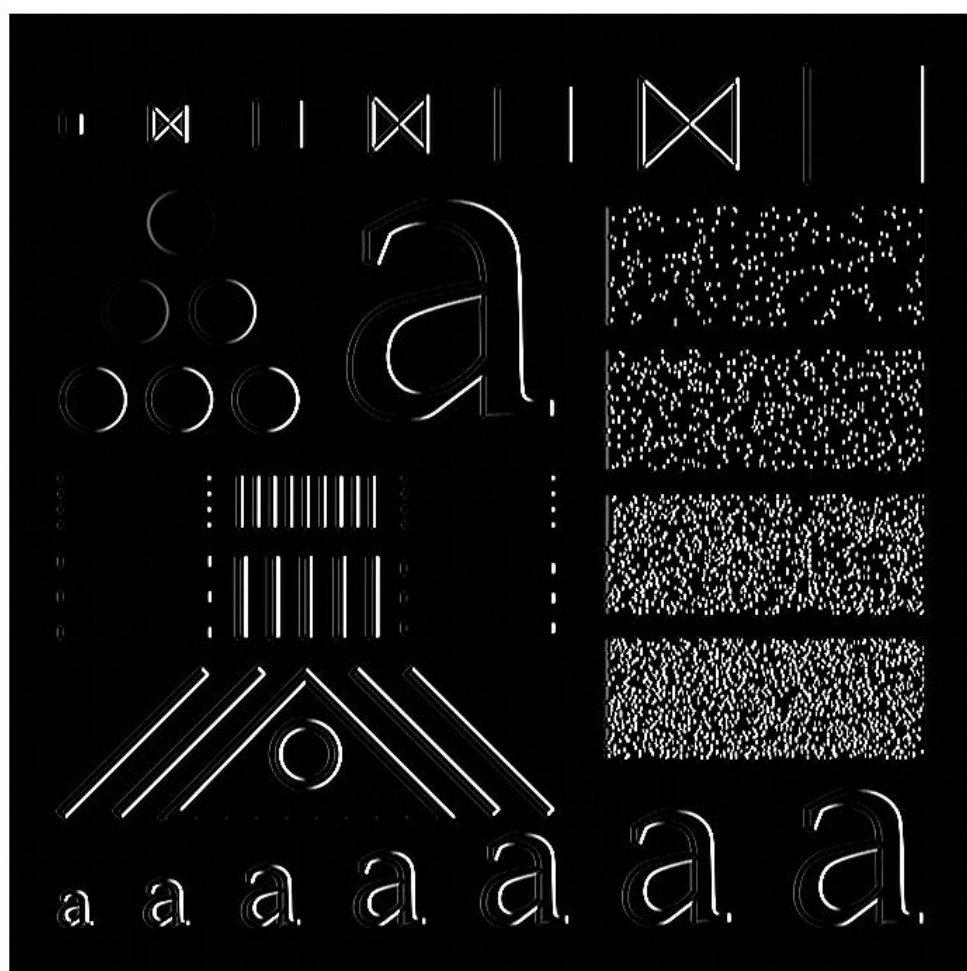


## 2) Testing Sobel filter kernels and gradient

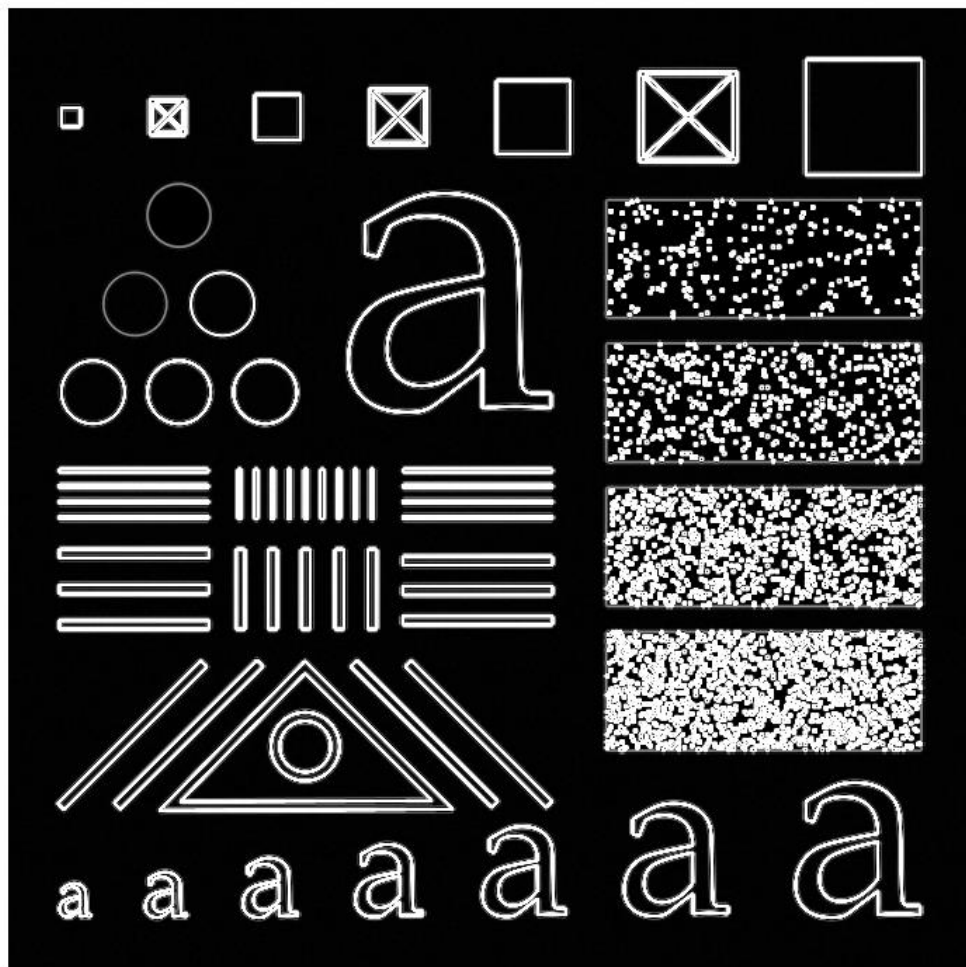
9) Image6:



10) Image7:



11) Image8:



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