Question 1

A) Histogram Matching:

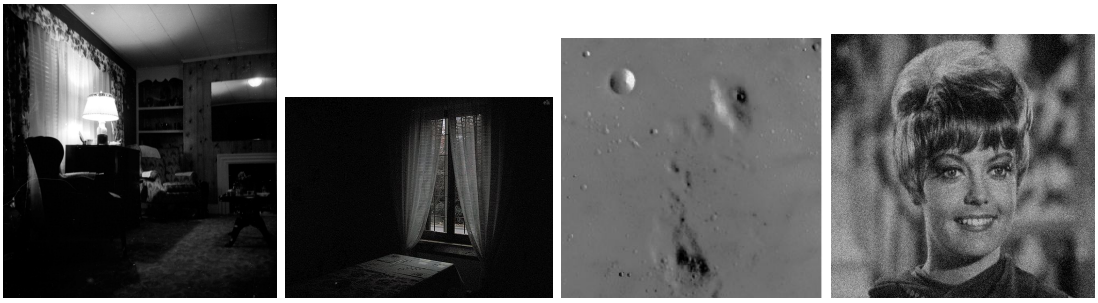


Fig 1: Images used as targets(histogram to achieve)

Fig 2: Images used as source(histogram to change)

Observation: More gray-levels the target image has, the more spread out the histogram of output image is.

B) Histogram Equalization:

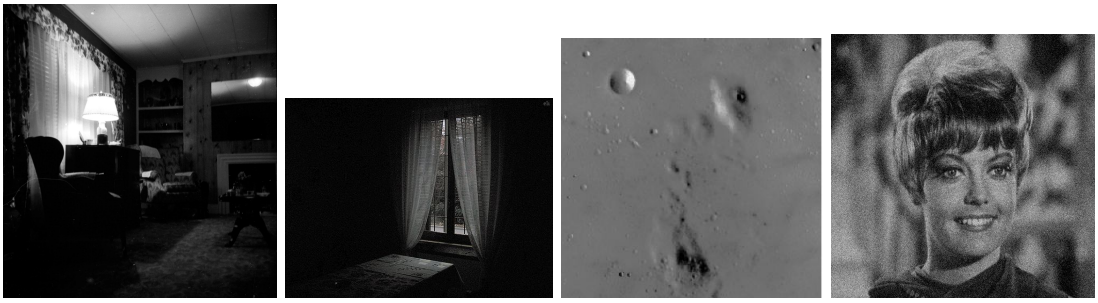


Fig 3: Input Images

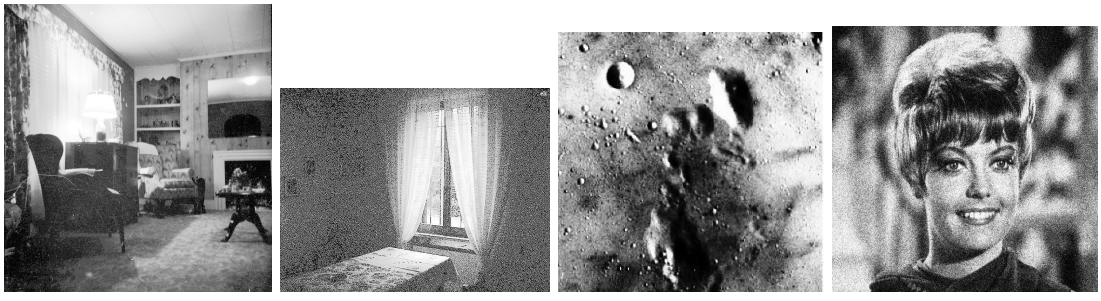


Fig 4: Images with equalized histograms

Observation: As we can see, equalized images have better contrast and hence, more features are visible to naked eye.

Question 2

A) Gaussian Filtering:


filter_size=3, σ=1


filter_size=5, σ=1


filter_size=8, σ=1


filter_size=3, σ=5


filter_size=3, σ=15


filter_size=3, σ=30

Observation: Increase in filter size results in more computational time. Increase in sigma(variance) results in much blurred images as weight of neighbourhood pixels increases. Big filter size along with higher value of rho will lead to effective blurring but with more computational time. Hence, optimal values should be choosed based on data.

B) Median Filtering:

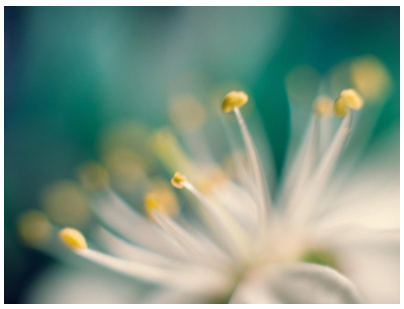
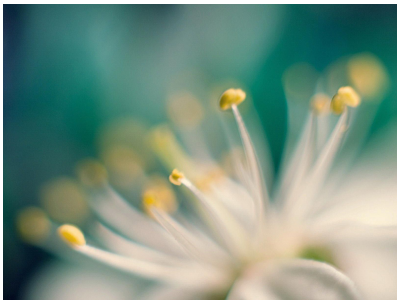
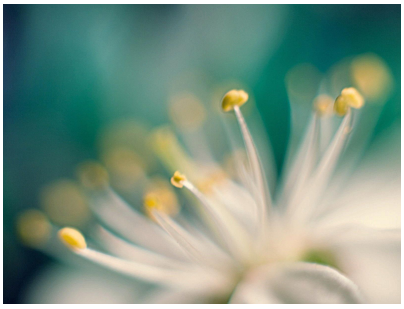

filter_size = 3


filter_size = 5

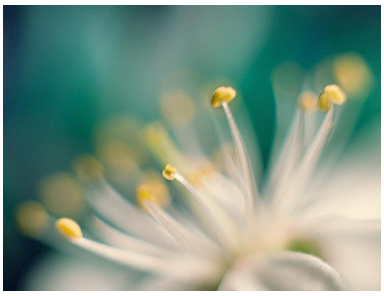

filter_size = 8

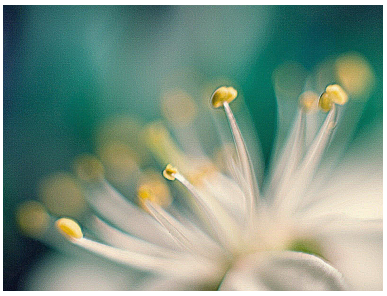
Observation: Fore removing salt-pepper noise, small size median filter is recommended. Increase in filter size will lead in more computational time along with more smoothing(removing needed information).

C) High-boost Filtering:

filter_size =3, λ=1 filter_size =5, λ=1 filter_size =8, λ=1

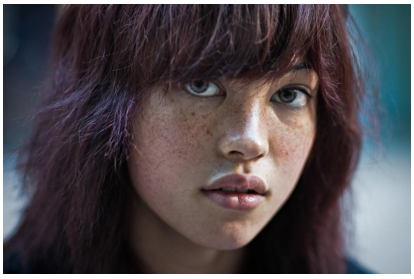
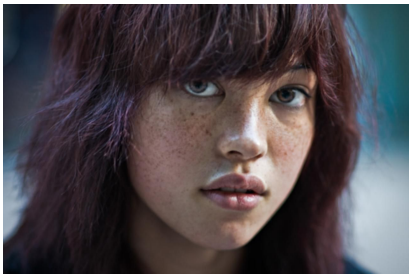




filter_size =3, λ=5 filter_size =8, λ=10 filter_size =8, λ=15

Observation: To get appropriate sharpening, increase in filter size will not have desire effect unless we increase λ(Multiplier for adding edges to image). Hence λ should be choosen accordingly.

D) Bilateral Filtering:


filter_size=3,σ_x=8,σ_r=90 filter_size=5,σ_x=8,σ_r=90 filter_size=8,σ_x=8,σ_r=90

Observation: In Bilateral filter, with an increase in σ_x(spatial variance) we increase the neighbourhood effect on a pixel and with an increase in σ_r(intensity variance) we increase the effect of intensities on the pixel. With appropriate variance values, edges in an image can be preserved, but with a penalty of more computational time.

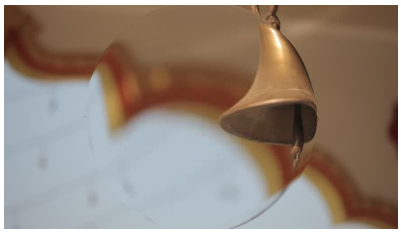
Question 3

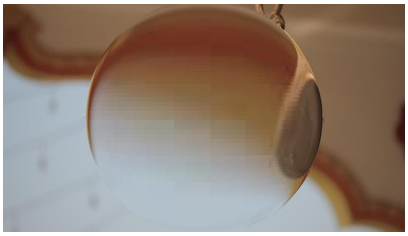
A) Ripple Filter:


aX = 10, aY = 15,tX = 120,tY = 150; aX = 10, aY = 15,tX = 180,tY = 250;

Observation: In ripple filter, by changing the values of a and t for both dimensions, we can produce different deviations of current image or correct a given one.

B) Spherical Filter





r=250, rho=2 r=250, rho=5 r=250, rho=10

Observation: in spherical filter, by changing the values of r(radius) and rho(spread), we can achieve desired results. As can be seen, increasing the value of rho pushes the pixels outside, with a bigger radius and bigger rho, we can achieve the effect of ‘zoom in’ for an image.