




## Homework 2

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### Part 1

2.5   $c = f\lambda$   
 $c = 3 \times 10^8 \text{ m/s}$   
 $f = 60 \text{ Hz}$   
 $\lambda = 5 \times 10^6 \text{ m} = 5000 \text{ km}$

2.6   $f = \frac{c}{\lambda}$   
 (a)  $f_0 = \frac{3 \times 10^8}{50 \times 10^{-6}} = 6 \times 10^{12} \text{ Hz}$   $\lambda_0 = 5 \times 10^{-5} \text{ m}$  infrared  
 $f_1 = \frac{3 \times 10^8}{10^{-6}} = 3 \times 10^{14} \text{ Hz}$   $\lambda_1 = 1 \times 10^{-6} \text{ m}$  infrared  
 $f_{0.1} = \frac{3 \times 10^8}{0.1 \times 10^{-6}} = 3 \times 10^{15} \text{ Hz}$   $\lambda_{0.1} = 1 \times 10^{-7} \text{ m}$  Ultraviolet  
 $f_{0.01} = \frac{3 \times 10^8}{0.01 \times 10^{-6}} = 3 \times 10^{16} \text{ Hz}$   $\lambda_{0.01} = 1 \times 10^{-8} \text{ m}$  X-ray  
 $f_{0.001} = \frac{3 \times 10^8}{0.001 \times 10^{-6}} = 3 \times 10^{17} \text{ Hz}$   $\lambda_{0.001} = 1 \times 10^{-9} \text{ m}$  X-ray  
 So we just use the smallest wavelength to choose our camera.  
 The wavelength band is ~~10~~  $1 \times 10^{-9} - 5 \times 10^{-5} \text{ m}$   
 and camera type is X-ray

2.6 The two subsets are not 4-adjacent. They are 8-adjacent and m-adjacent.

2.23 Because they have the same size, elementwise product always make sense. To do matrix product, we need the sizes are  $m \times n$  and  $n \times m$ , so they should be vertical.

2.39 For a scaling transformation

$$A = \begin{bmatrix} a_{11} & 0 & 0 \\ 0 & a_{22} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\text{so } x' = a_{11}x \Rightarrow x = \frac{1}{a_{11}}x'$$

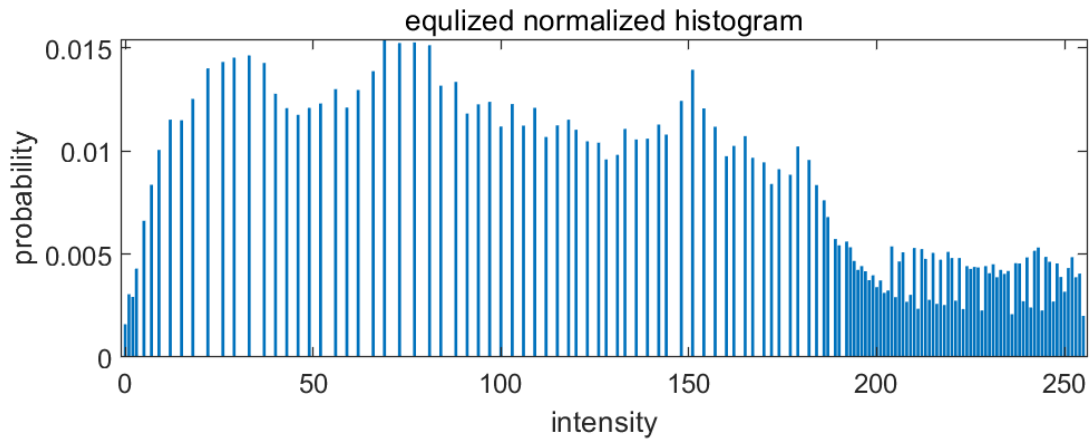
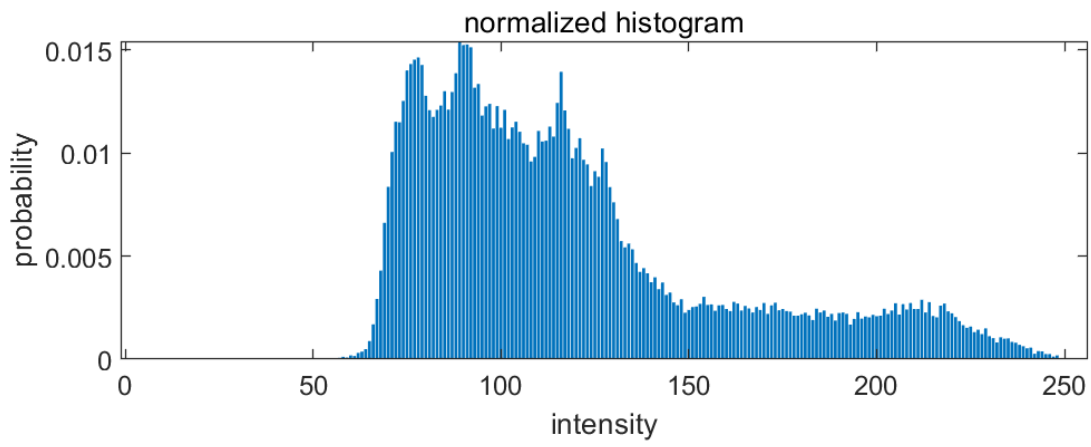
$$y' = a_{22}y \Rightarrow y = \frac{1}{a_{22}}y'$$

$$\text{so } A^{-1} = \begin{bmatrix} \frac{1}{a_{11}} & 0 & 0 \\ 0 & \frac{1}{a_{22}} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

## Part 2

By the examination of histogram we can infer the intensity range in the photo and its contrast.

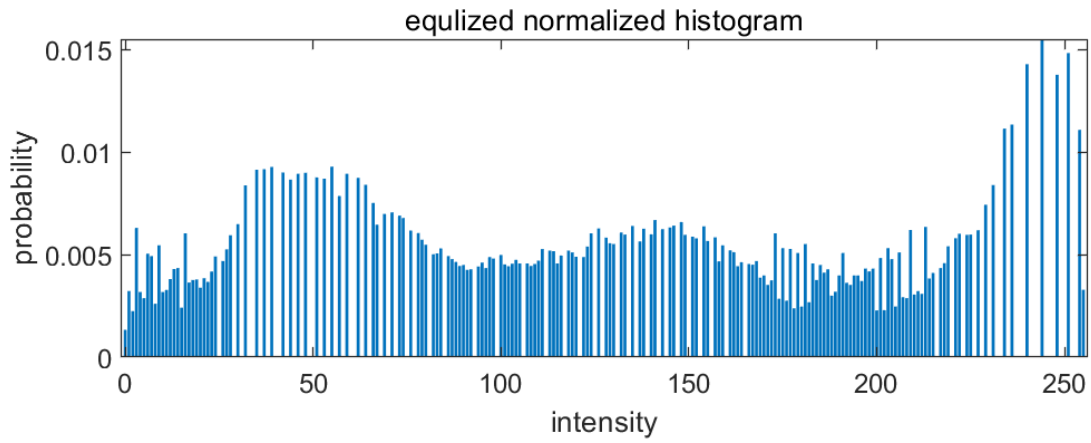
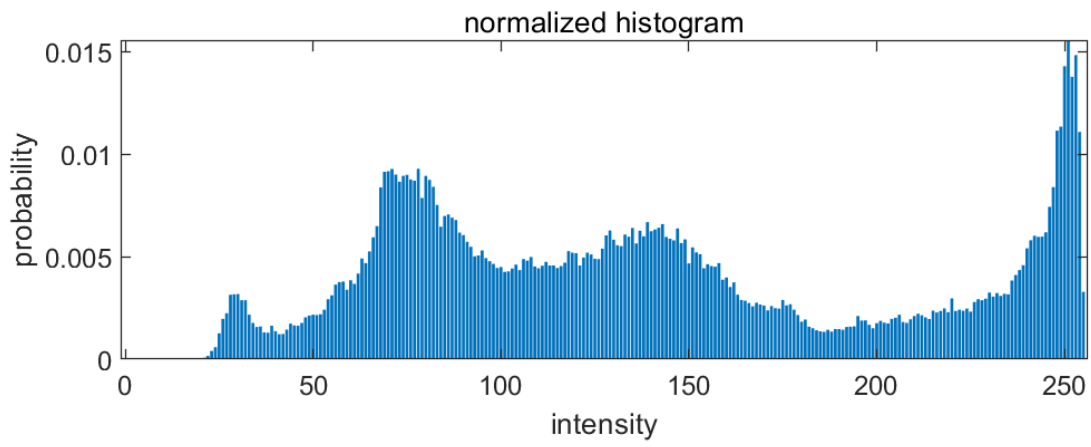
## Flower



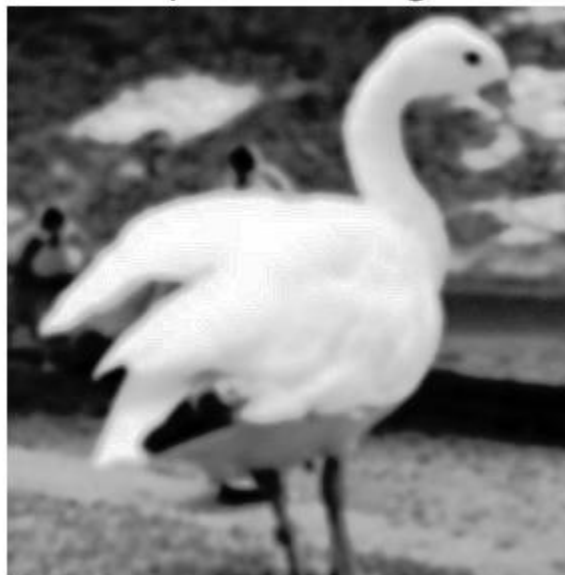
Equlized image



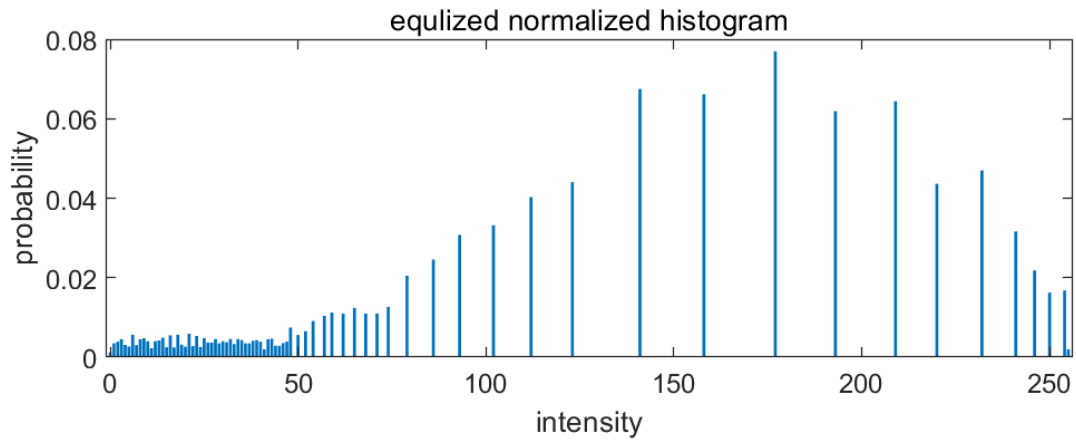
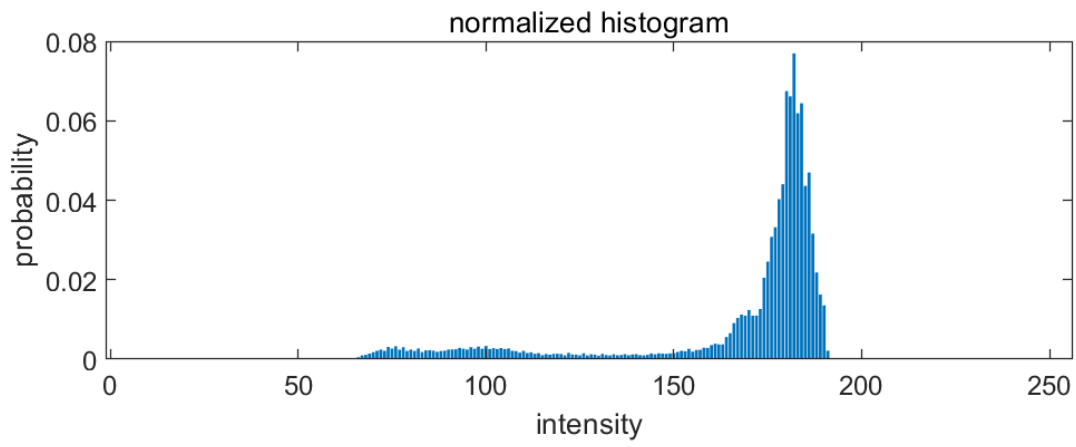
## Swan



Equlized image



## Tools



Equlized image

