2.5

$$\lambda = \frac{c}{v} = \frac{3 * 10^8}{60} = 5 * 10^6\, m$$

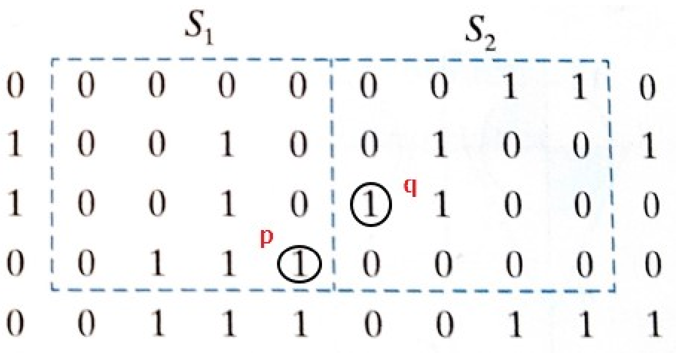
2.10

One solution to this project is to have 3 monochromic cameras which only covered one of blue, green, red filters on each lens. Theses 3 cameras should just focus on part of vehicle that presents single color to avoid noise. The vehicle color can be recognized by the strongest response of the camera, e.g. when the green vehicle passed the camera area, camera with green filter can receive light while other two is black. When three cameras all receive light then the vehicle is white.

2.16

S1 and S2 is 8-adjacent and m-adjacent.

a) P is not in $N_4(q)$, vise versa, S1 and S2 is not 4-adjacent
b) P is in $N_8(q)$, vise versa, S1 and S2 is 8-adjacent.
c) P is in $N_D(q)$, vise versa; and $N_4(p) \cap N_4(q) = \emptyset$, S1 and S2 are m-adjacent.



2.23

For elementwise products image f and image g should have identical orientations, e.g. they should all be row vector or column vector.

For matrix products image f and image g should be different orientation, one should be row vector the other should be column vector.

2.39

For Translation

$$x' = x + t_x$$
$$y' = y + t_y$$

$$A^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -t_x & -t_y & 1 \end{bmatrix}$$

For vertical shear:

$$x = x' - s_v y$$
$$y = y'$$

$$A^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ -s_v & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

For horizontal shear:

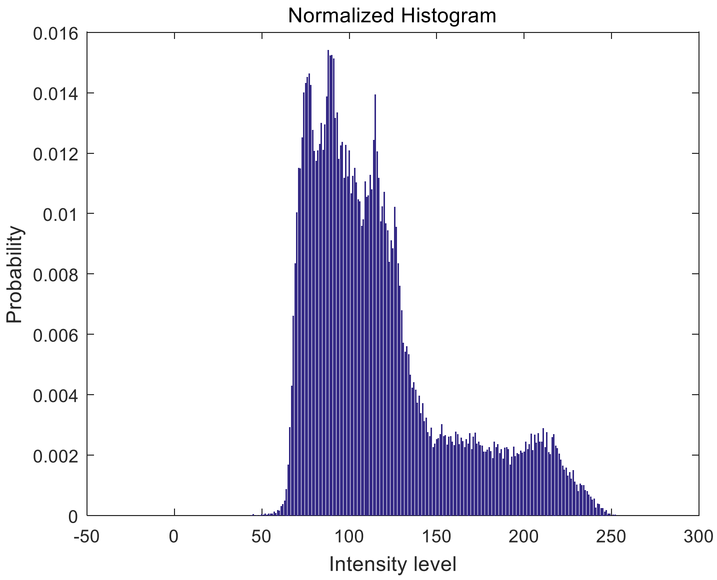
$$x = x'$$

$$y = y' - s_h x$$

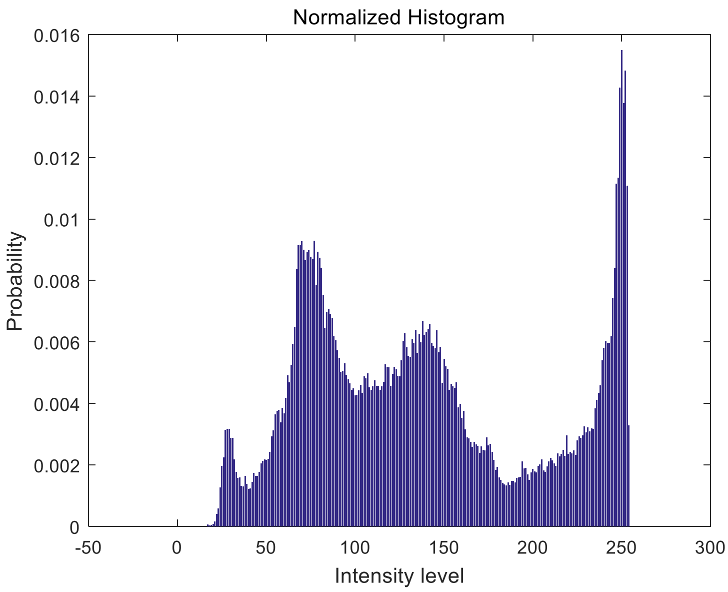
$$A^{-1} = \begin{bmatrix} 1 & -s_h & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Section 2 :

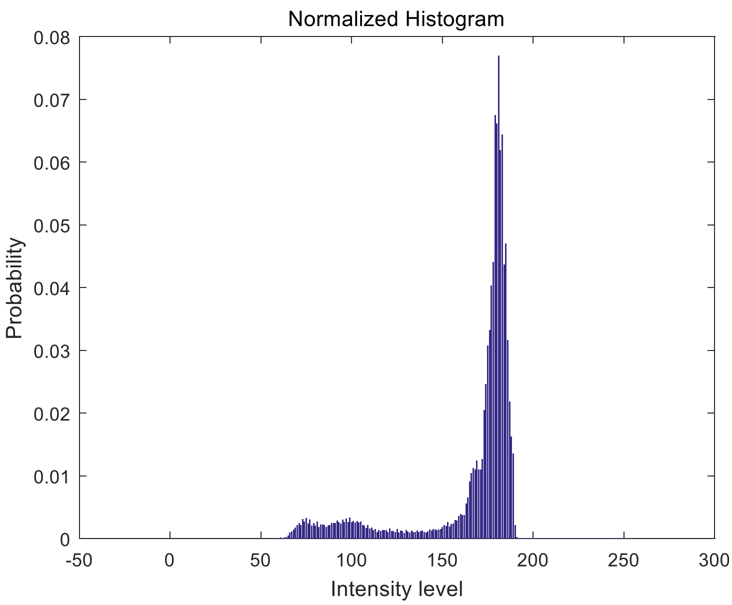
Flower.pgm’s normalized histogram:

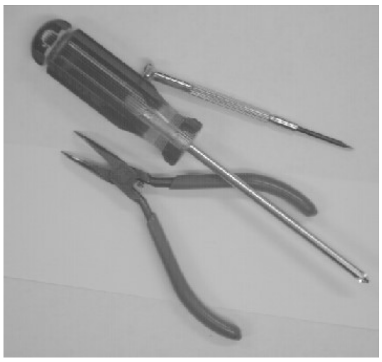


Swan’s.pgm’s normalized histogram:



Tools.pgm’s normalized histogram

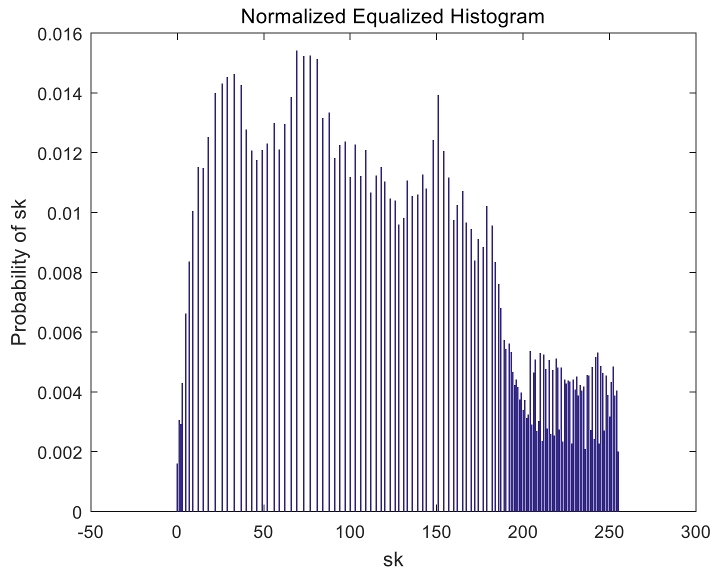




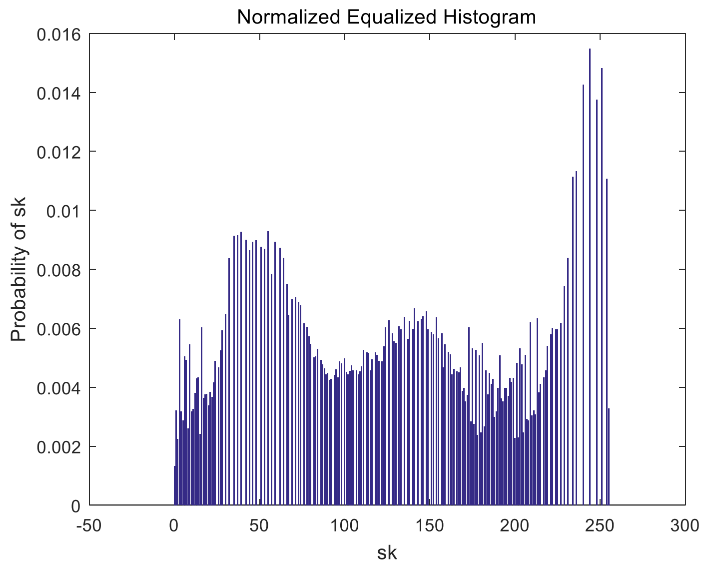
From the normalized histogram of each picture, we can infer that:

a) Flower's histogram has more middle level intensity scale, which makes the picture low contrast.
b) In the other hand, swan's histogram concentrates in high intensity scale level, then we can see the picture is light.
c) The tools' histogram has a uniformed distribution intensity level despite a peak on certain intensity level, which means the picture is high-contrast.

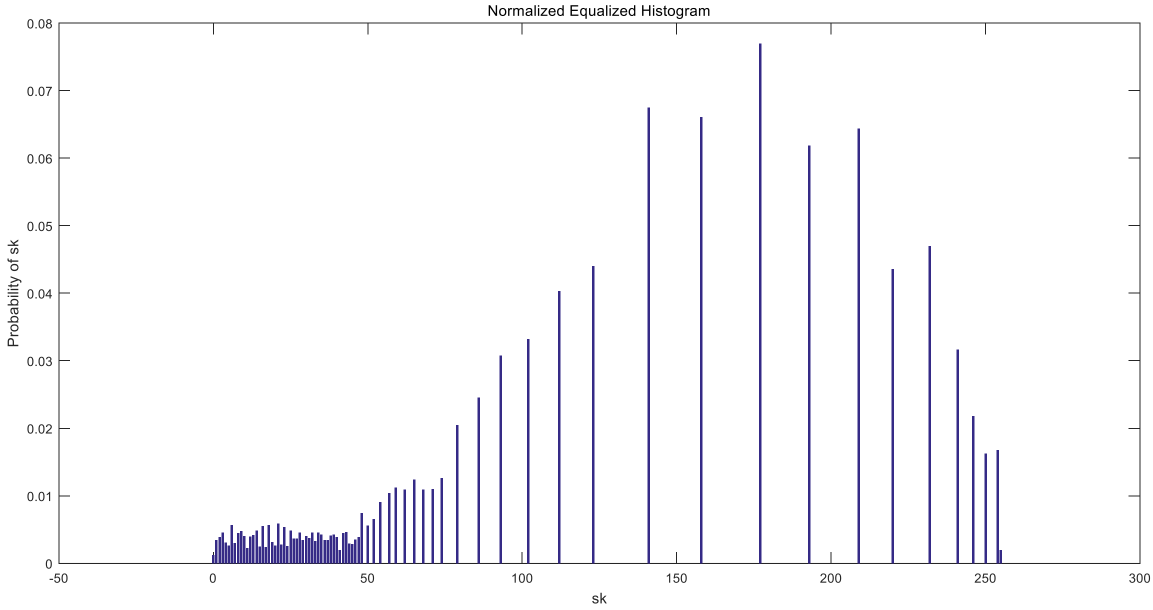
Flower's normalized equalized histogram:



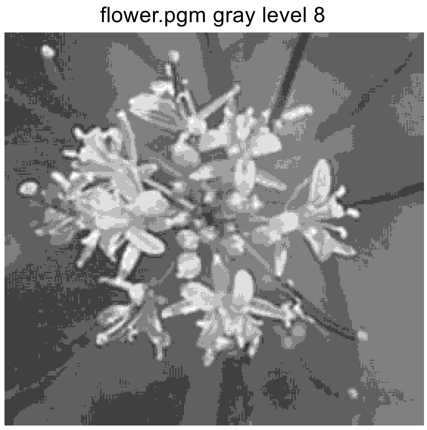
Swan's normalized equalized histogram:



tool's normalized equalized histogram:



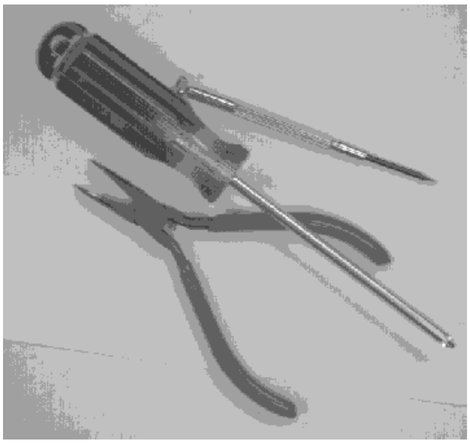
flower's 8-level image:



swan's 8-level image:

tool’s 8-level image:

tools.pgm gray level 8



Description of algorithm

% a) scan every pixel in original image

% b) group every pixel into the grayscale group;eg when quant_num=8;

% i(x,y)=30, then i(x,y) should be group 1;

% c) The quantilized gray intensity of each pixel is the pixel's grayscale group

% number multiply the maximmun gray intensity of it's group. e.g. apply

% example in b) the quantilized gray intensity is group number(1)*32, as we

% have 8 gray scale, each 32 gray intensity makes up on group.