**ENED 1091 Homework Assignment #2**
**Due: Week of Feb 26th at the beginning of your Recitation Section**

**Problem 1:** Work through the following MATLAB code by hand and fill in the table. Then check your results using MATLAB.

```
M = [5  2  -3; -4  0  5; 9  0  1];
[nrows, ncols] = size(M);
S = zeros(1,nrows);
for row = 1:nrows
    S(row) = M(row,1);
    for col = 2:ncols
        if M(row,col) < S(row)
            S(row) = M(row,col);
        end
    end
end
```

| | | S |
|---|---|---|
| **Before Loops** | | [ 0 0 0] |
| **row** | **col** | |
| 1 | - | [ 5 0 0] |
| 1 | 2 | [ 5 2 0] |
| 1 | 3 | [ -3 2 0] |
| 2 | - | [ -3 -4 0] |
| 2 | 2 | [ -3 -4 0] |
| 2 | 3 | [ -3 -4 0] |
| 3 | - | [ -3 -4 9] |
| 3 | 2 | [ -3 -4 0] |
| 3 | 3 | [ -3 -4 0] |

***Note: The dash in the col column indicates just prior to entering the inner loop***

**Problem 2:** Work through the following MATLAB code by hand and fill in the table. Then check your results using MATLAB.

```
M = [2  3  1;  -4  4  6; -3  2  5;  1  -1  0];
[nrows, ncols] = size(M);
Add = zeros(1,ncols);
Total = 0;
for col = 1:ncols
    for row = 1:nrows
        Add(col) = Add(col) + M(row,col);
    end
    Total = Total + Add(col);
end
```

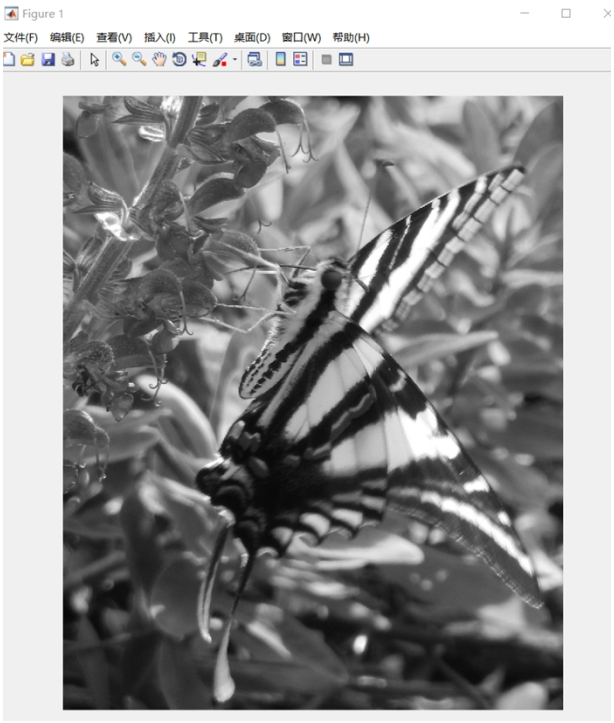
| | | Add | Total |
|---|---|---|---|
| **Before Loops** | | [ 0 0 0] | 0 |
| **row** | **col** | | |
| 1 | 1 | [ 2 0 0] | 0 |
| 2 | 1 | [ -2 0 0] | 0 |
| 3 | 1 | [ -5 0 0] | 0 |
| 4 | 1 | [ -4 0 0] | -4 |
| 1 | 2 | [ -4 3 0] | -4 |
| 2 | 2 | [ -4 7 0] | -4 |
| 3 | 2 | [ -4 9 0] | -4 |
| 4 | 2 | [ -4 8 0] | 4 |
| 1 | 3 | [ -4 8 1] | 4 |
| 2 | 3 | [ -4 8 7] | 4 |
| 3 | 3 | [ -4 8 12] | 4 |
| 4 | 3 | [ -4 8 12] | 16 |

**Problem 3:** Download the HW2.mat file from Blackboard and save it to your current MATLAB folder. At the MATLAB command prompt, type the following:

```
>> load HW2; imshow(Butterfly)
```

You should see a grayscale image of a Butterfly. Paste the original image in the space below.

**ORIGINAL IMAGE**

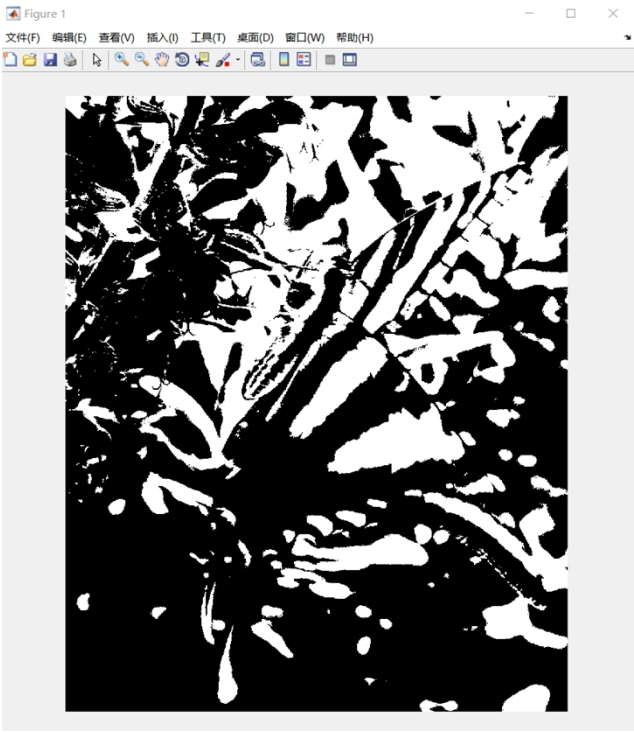



Notice that Butterfly is a 2-d array (matrix) of type uint8. Each entry in the matrix is a pixel of the digital image. All entries are in the range of 0 to 255 (the range of an 8 bit unsigned integer). A pixel value of 0 is Black, a pixel value of 255 is White, and pixel values in between create 254 shades of grey – getting progressively lighter as value increases.

(a) Create a script file that will first load the Butterfly image (`load HW2`). Then create a ***nested for loop*** that will look at the value of each pixel (entry) in the Butterfly image (matrix). If a pixel value is larger than 125, the value will be replaced with 255 (White). If a pixel value is not larger than 125, the value will be replaced with 0 (Black). Use the imshow command to display the modified image. It should be purely Black and White (no shades of grey). Run your script and paste the modified image and the MATLAB code in the space below.
***Note: if you decide to create a new matrix for the new image, make sure it is of type uint8 and not the default of double. This can be done as follows:***

```
NewPic = uint8(zeros(size(Butterfly))); or  NewPic = Butterfly;
```

**MODIFIED IMAGE and SCRIPT COMMANDS:**




```
%% HW1 P3
% Name:  Horace
% Date: 19 Feb 2019

%% Code
%clear processor
load HW2;imshow(Butterfly)
NewPic=uint8(zeros(size(Butterfly)));
for x = 1:2572
    for y = 1:2101
        if Butterfly(x,y)>125
            NewPic(x,y)=255;
        else
            NewPic(x,y)=0;
        end
    end
end
imshow(NewPic)
```

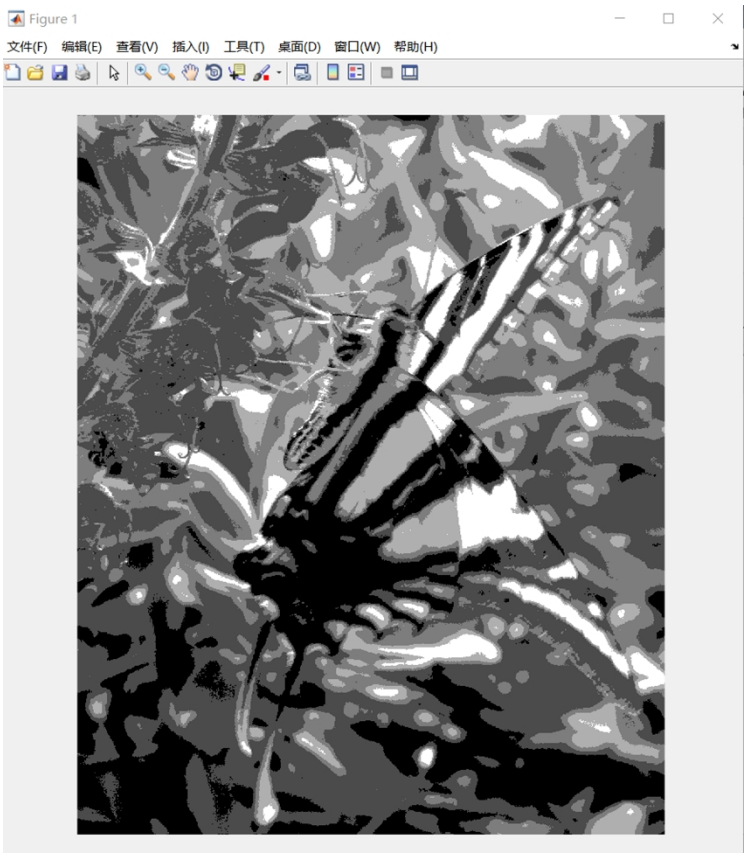
(b) Create another script file that will first re-load the original Butterfly image (`load HW2`). Then create a ***nested for loop*** that will look at the value of each pixel (entry) in the Butterfly image (matrix). Modify each pixel in the Butterfly matrix using the table below. Run your script and paste the modified image and the MATLAB code in the space below.

***Note: if you decide to create a new matrix for the new image, make sure it is of type uint8 and not the default of double. This can be done as follows:***

```
NewPic = uint8(zeros(size(Butterfly))); or  NewPic = Butterfly;
```

| Original Pixel Value | New Pixel Value |
|---|---|
| Value > 200 | New Value = 255 |
| 150 < Value ≤ 200 | New Value = 175 |
| 100 < Value ≤ 150 | New Value = 125 |
| 50 < Value ≤ 100 | New Value = 75 |
| Value ≤ 50 | New Value = 0 |

**MODIFIED IMAGE and SCRIPT COMMANDS:**




```
%% HW1 P3 (b)
% Name:  Horace
% Date: 19 Feb 2019
%% Code
%clear processor
```

```
load HW2;imshow(Butterfly)
NewPic=uint8(zeros(size(Butterfly)));
for x = 1:2572
    for y = 1:2101
        if Butterfly(x,y)>200
            NewPic(x,y)=255;
        elseif Butterfly(x,y)>150 && Butterfly(x,y)<=200
            NewPic(x,y)=175;
        elseif Butterfly(x,y)>100 && Butterfly(x,y)<=150
            NewPic(x,y)=125;
        elseif Butterfly(x,y)>50 && Butterfly(x,y)<=100
            NewPic(x,y)=75;
            else
                NewPic(x,y)=0;
        end
    end
end
imshow(NewPic)
```

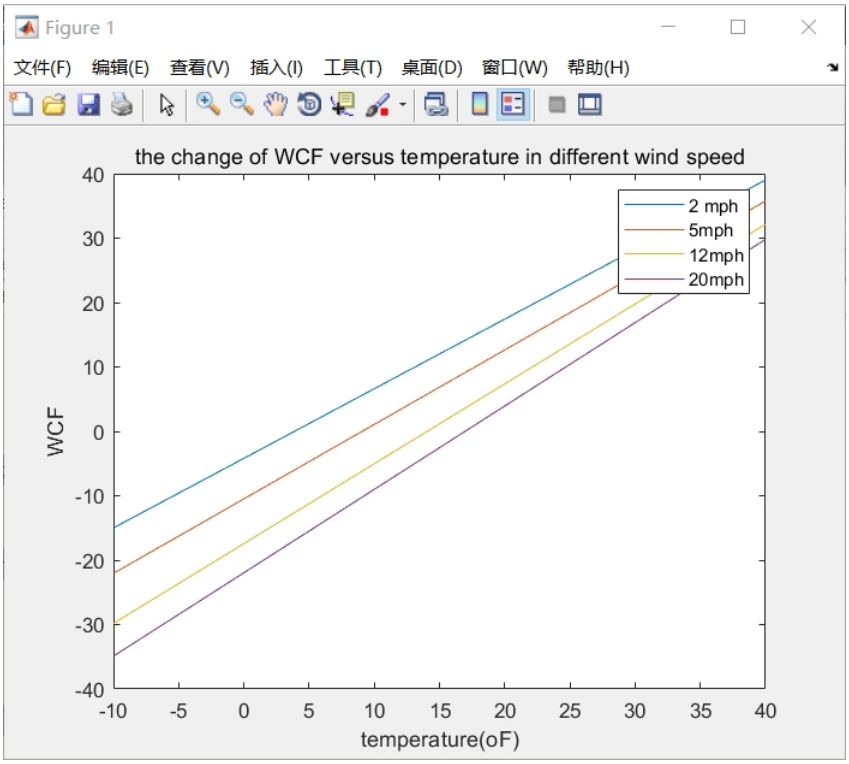
**Problem 4:** The wind chill factor (WCF) in °F describes how cold it "feels" for a given temperature T, in Fahrenheit, and a given wind speed V (in miles per hour). The equation for wind chill factor is:

$$WCF = 35.7 + 0.6T - 35.7(V^{0.16}) + 0.43T(V^{0.16})$$

Add a new section to your script file. Create a vector for temperature, T (°F), ranging from –10 to 40 incrementing by 5°F. Create a vector for wind speed, V (mph), with four values: 2, 5, 12, 20. Use a ***nested for loop*** to create a matrix (table) of the Wind Chill Factor for the given temperatures and wind speeds. Each row should contain the wind chill factor at all temperatures in T for a constant wind speed. For example, Row 1 of your matrix should contain the wind chill factor for all temperatures in the T vector assuming a wind speed of 2 mph. Plot your matrix of data on a single plot. Temperature should be on the x-axis, wind chill factor (°F) should be on the y-axis, and a legend indicating wind speed should be added. Add x and y labels (with units) and a title to your plot.

***Note: it is possible to do this problem without a nested loop but you must use a nested loop to get full credit for this problem!***

**PASTE PLOT and SCRIPT COMMANDS:**




```
%% HW1 P4
% Name: Horace
% Date: 19 Feb 2019

%% Code
%clear processor
close all; clc;close all;

%set the temperature
T=-10 :5:40;
% wind speed
V=[2, 5, 12, 20];
% calculate WCF
WCF=zeros(length(V),length(T));
for r=1:length(V)
    for c=1:length(T)
        WCF(r,c)=35.7+0.6*T(c)-
35.7*(V(r)^(0.16))+0.43*T(c)*V(r)^(0.16);
    end
end
% make the plot
plot(T,WCF)
```

```
legend('2 mph','5mph','12mph','20mph')
xlabel('temperature(oF)')
ylabel('WCF')
title('the change of WCF versus temperature in different
wind speed')
```