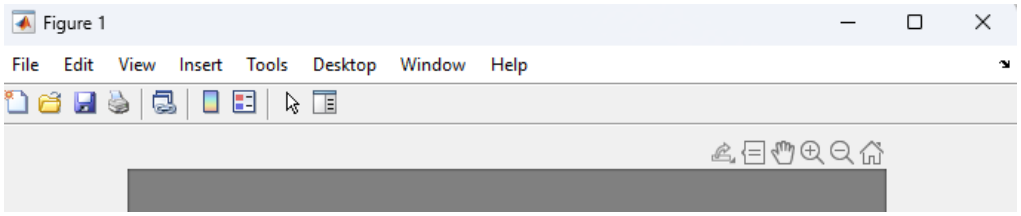
SCHOOL OF ENGINEERING SCIENCE
SIMON FRASER UNIVERSITY
ENSC 180 Introduction to Engineering Analysis
Lab 2: Due Thursday Jan. 23, 21:00PM

Question 1 (60 points)
(Instructor use only: CEAB indicators: 1.2, 2.2, 2.3, 2.4, 5.2, 7.5)

In this question, you need to create a Matlab script file to perform the following tasks:

1. Read the image **circles.png**, get its size, and use the `imshow( )` command to display the image in a figure.

2. In the image figure, move the mouse cursor inside the image, six gray icons will show up above the upper right corner of the image, as shown below.



   Click the **second** icon from the left, which is called **Data Tips**, and it will turn to blue. Then move the mouse cursor to different positions of the image, and click the mouse. Matlab will display the X and Y coordinates, pixel index (also known as pixel value), and R/G/B components at that position. The displayed information can be deleted by right clicking the mouse and selecting Delete Current Data Tip.

   Discuss your observations of the pixel indices of this image in your report.

3. Use FOR loops to count how many positions in the image have pixel index of 0 (black), 255 (white), and 128 (gray), respectively. Display the statistics after the loops by writing the variable names without using ; at the end.

4. Create a new array of the same size as the original image, and first fill up all positions in the array with value 128, using the ones( ) function. Then find all positions in the original image with pixel index equaling 255, and set the co-located positions in the new array as 255 too. Try to do this without using for loop.

   Display the new array using the following commands:

   figure;

imshow(newimg, [0, 255]);

where newimg is your new array name (you can use other names), and 0 and 255 specify the values that will be displayed as black and white respectively. We need to specify 0 and 255 here because the data type of the new array is double by default, instead of uint8.

5. Create another new array of the same size as the original image, and first fill up all positions in the array with value 128. Then find all positions in the original image with pixel index equaling **0**, and set the co-located positions in the new array as **0** too. Try to do this without using for loop. Display the new array as in Step 4 above.

6. Use the figure command to create a new figure. Then use the tiledlayout( ) function with 'flow' arrangement and nexttile to display the original image and the two new images above in the same figure.

Question 2 (40 points) Plotting
(Instructor use only: CEAB indicators: 2.3, 2.4, 5.2, 7.5)

Create a Matlab script to do the following:

1: Define X = 1 : 10;
2: Create a 5 x 10 array Y. The first row is generated by the randn( ) function. After that, each row adds 1 to the previous row, for example, Y(2, :) = Y(1, :) + 1, and Y(3, :) = Y(2, :) + 1. We assume the five rows represent the results of five methods, i.e., Method i for the i-th row (i = 1 to 5).

Use the plot( ) command to plot the five rows in one figure, using X as the x axis. The plot should meet the following requirements.

1) The highest curve should have red color, solid line, circle marker, and line width of 2.
2) Any two curves should have at least two different line properties (line style, color, and marker).
3) The X label should be 'Bits/Pixel (BPP)'.
4) The Y label should be 'MSE'.
5) Turn on the grid.
6) Add a legend, and use the mouse to move the legend so that it blocks as few curves as possible.

Note the solution is not unique, as there are many different ways to meet the requirements. Also, each time you run the code, the result will be different due to the randn( ) function.