ELECENG 3TP3

Lab 1 Report

Due Date: Oct 19th @ Midnight

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Question 1

For the first question of this lab report, various discrete time signals were to be plotted on a graph. Before doing this, we had to define a "`unitstep`" function that would be used to represent the unit step function u(t)={1, x>=0; 0, x < 0}. Using that, we needed an input range (for n) that out signals would plot over. For this, we chose the interval [-10, 20]. This interval allows us to represent all the discrete time signals and get a very good idea of their characteristics.

Finally, it was a matter of implementing all these time signals, and storing their values in a matrix which we named Xa, Xb, Xc and Xd (corresponding with the 4 different time signals we were asked to plot). Something worth noting is that we did not create a separate function for the dirac delta function used in part (c). Instead we used the syntax:

$$\delta[n-k] = ((n-k) == 0)$$

This was an effective solution as if n and k were equal, then the first term would evaluate to 0, and that would make the overall term true (or a 1). Otherwise the overall term would evaluate to false (or a 0). This is in line with how the dirac delta function acts, as it returns a 1 when the parameters inside its brackets evaluate to 0.

Other than that, all the discrete time signals were plotted, and our names and student numbers were added to them before they were saved as JPEGs.

Question 2

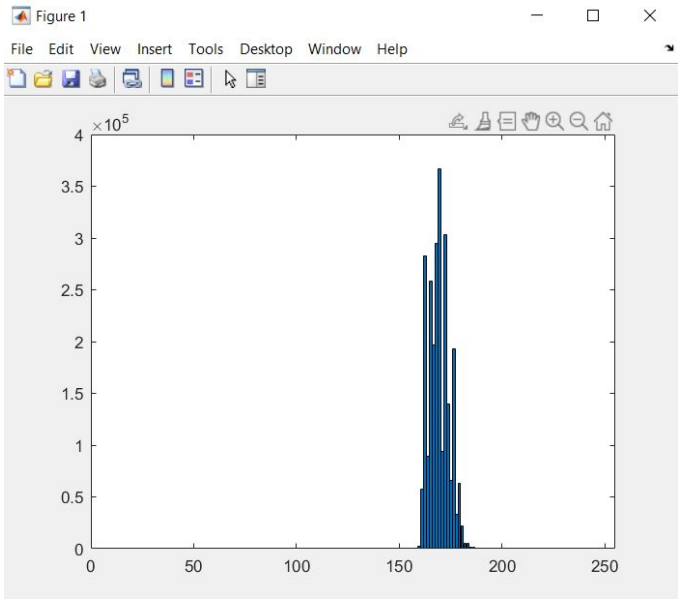
For question 2, we were asked to create a function that when given a set of student grade records, a maximum grade vector and a vector of column indices, it should return a vector of grade averages for the corresponding column indices. Then after that had been tested and functional, we had to implement various operations with this function. In an update for this question, it noted that the spreadsheet we were given "course_grades_2020.csv" was open for interpretation, and however we decided to approach the problem, we had to make a note of it here.

Our group approached the problem by calculating the mean across all the column indices and saving that value. Then to calculate the average that each student has received, we averaged out the total number of marks for each category (LAB_AVG, MIDTERM_AVG, EXAM_AVG), then divided whatever mark the student received for each category by the average total number of marks possible. This way, we were always working with averages and that made life simpler because of the consistency across all parts of the matlab code/calculations. Then finally for calculating the total mark for each student, I divided their average for each category by the total average for each category, then multiplied that by the corresponding weighting. Finally I added all those values up to get the final grade for each student.

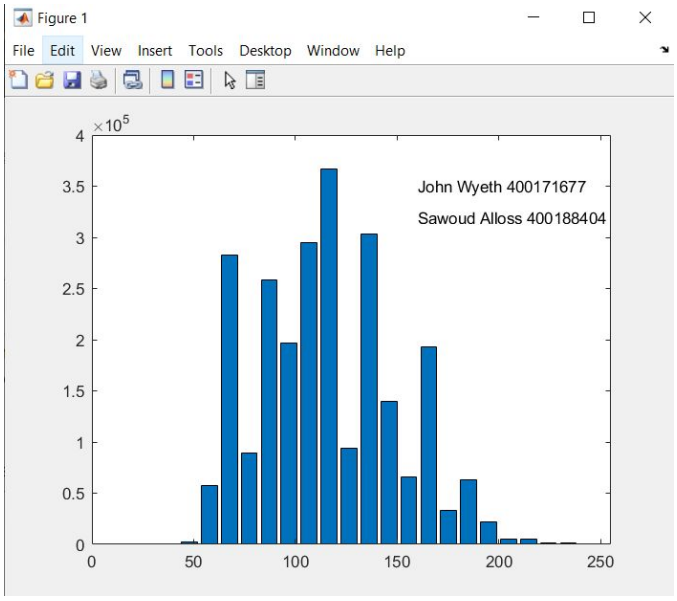
Then the final grades were plotted in descending order. However the corresponding student numbers are not in that graph as the student numbers aren't descending sequentially with the grades, so instead on the x-axis is just a counter from 1 to 20.

Question 3

For question 3, it asks us to perform some image processing to improve the resolution of the grayscale image “ee3tp3picture2020.png”. To do this, first we needed the image in terms of it’s pixels as unsigned 8 bit integers. Once we have that, we can plot the initial histogram of pixel value vs number of occurrences for each value. The initial histogram was:



This shows a noticeable collection of pixels around the range of 160 to approximately 180. This means that the image is mostly “white” as it has most of its pixels more to the white end of the spectrum. This can be seen if you view the given image, it appears very white, and therefore the contrast makes it difficult to distinguish what the image is. What we want for better resolution is for the histogram to be fairly spread out overall the entire 8 bit range [0, 255]. Through some trial an error with adjusting the values of α and β we were able to produce the following histogram:



This new histogram shows a noticeable improvement on the range of pixel values. And this is apparent in the new image (“new_image”), as it’s new contrast makes it much easier to distinguish the rabbit among leaves.