**Exercise #3 - Simple Data Analysis and Graphics**

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**Instructions**

The mail subject should be: 'matlab intro 2021b exercise 3'. Attach only the script file to your mail.

Name your script "hw3\_<ID 1>\_<ID 2>.m".

Please read the HW guidelines and fulfill them.

Do not use loops in this ex.

Pay attention to the output requirements (title, axis labels, subplots…)

Do *not* use “magic numbers” – you should assign these values to variables.

**Data description**

Please download the files *conductivity.mat* and *conductivity.xls*. This file contains a table of electrical conductivity values as a function of concentration for various electrolytes in aqueous solution at 25 °C. In order to understand the dataset please review the spreadsheet in Excel before loading the \*.mat file into matlab. For section h you will need *pH\_in\_solution.mat* and *pH\_in\_solution.xls* which include pH values of several solutions as a function of temperature.

**Question 1- the plot**

1. Load the file *conductivity.mat*.

You should have 3 variables:

*concentration* – electrolyte concentrations for which conductivity was measured.

*conductivity* – conductivity values of several electrolytes measured across concentration.

*electrolyte\_names* – names of the electrolytes.

1. Calculate the mean and the median conductivity of the electrolytes across concentration values (i.e. one mean/median value per concertation). Store the information in appropriate variables. Use short and meaningful names for your new variables. You can use the help command to learn about the mean and median functions.
2. Figure 1: Plot the mean and the median conductivity vs. concertation – in the same graph, each one with a different color. Line width should be 2. Add an appropriate title to this graph. Add an appropriate x label and y label. Add a legend in the lower right corner of the axes, so it won’t cover the data lines. (Hint: you can use the functions: title, legend, xlabel, ylabel, plot and hold on).
3. Figure 2: For all electrolytes, except for HCl (*Do not remove it from the data*, You are expected to use HCl in the next questions), plot the conductivity as a function of concentration in the same graph. Calculate and display in the command window the minimal and maximal conductivity values that are shown in the plotted data. Set the axis limits to be the {minimal\_value-25} and the {maximal\_value+25}. Add a title, axis labels and legend which contain the electrolyte names. Important note: Don’t *assume* the index of the HCl electrolyte in the list, *find* it using code!
4. Figure 3: plot the maximal conductivity per each electrolyte (in the given range of concentrations) using the *bar* function. Don’t forget to add axis labels and a title.
5. Figure 4: Plot in blue lines the conductivity values for molecules have a single chlorine atom. Plot in red lines the conductivity of molecules having two chlorine atoms. Add axis labels a title and a legend. Note: Do not use fixed index for those molecules! make sure to automatically find those molecules using a string comparison function (*conatins* for example).
6. Figure 5: Find the electrolyte that shows the largest change (Max-Min values) in conductivity across concentrations and plot its conductivity values (in blue). In the same graph plot also the conductivity values for the electrolyte which changed the least (in red). Add axis labels a title and a legend.
7. Figure 6: Load the file pH\_in\_solution.mat (after reviewing the spread sheet pH\_in\_solution.xls)

You should have 3 variables:

*temp* – temperature of the solution in which the acidity (pH) was measured.

*pH* – acidity of each solution across different temperatures.

*solution\_names* – names of the solutions.

Use the function *subplot* to show two graphs on the same figure: the first graph should be pH as a function of temperature for all the acidic solutions (average pH<7) and the second graph should be pH as a function of temperature for all the alkaline solutions (average pH>7). Make sure to set the neutral pH value as the upper/lower ylimits accordingly (acidic/alkaline). Hint: don’t use the value 7 directly, assign it to a variable (i.e. avoid magic numbers).

**Question 2**

In this question we will visualize the electrolyte *condcutvity* data (from question 1) using the function *imagesc***.**

Figure 7: Use the **imagesc** function to plot this data. Don’t forget to add title and axis labels.

Use the function **colorbar** to include the color bar on the right side of the figure.

Remove the “y-axis” ticks. Use the function *colormap*and set the colormap to hot.

Figure 8: Create a new figure which is identical to the previous one (figure 7) only with a different color range using the function caxis([0 155]) (see help) .

What happened to the colors? In what cases will you use this function?