Wherever relevant, use $\alpha = 1 + \text{mod}(x, 3)$, where x is the last three digits of your registration number. Wherever relevant, plot signals with normalised axes, with an appropriate resolution for time and with appropriate labels and legends.

Problem 1. (Generating Signals)
Using the built-in functions in Matlab, generate plots for the following signals for $-1 \leq t \leq 1$ in different subplots:

1. $y1(t) = sin(20\pi\alpha t)$
2. $y2(t) = cos(5\pi\alpha t + \pi/4)$
3. $y3(t) = e^{-2\alpha t}$
4. $y4(t) = e^{-0.25\alpha t} sin(20\pi t)$

Problem 2. (Operation on user-defined functions)
Create a user-defined function $x(t)$ to generate a decaying exponential with α as the time constant. Plot the following for $-5 \leq t \leq 5$ in different subplots :

1. $x(t)$
2. $x(-t)$
3. $x(t - 1.5\alpha)$
4. $x(2\alpha t)$

Problem 3. (Importing Signals)

1. Import the ECG data from *ECGData.txt* file and plot the data as a function of samples.
2. Import rainfall data from *RainFallIndiaJan.txt* and *RainFallIndiaJuly.txt*, which contain the average rainfall during the month of July, across India. Plot the distribution using histogram. Compute the mean and standard deviation of the rainfall in January and July.
3. Import *track00*α*.wav* and play the audio.

Problem 4. (Amplitude Modulation)
Import the file *speech.wav* that contains the speech signal $s(n)$ with F_s as the sampling frequency. Write a user-defined function to obtain

$$y(n) = s(n)cos(2\pi\frac{F}{F_s}). \tag{1}$$

Generate $y(n)$ for a particular choice of $F = 250\alpha$ Hz. Plot $s(n)$ and $y(n)$. Can you notice the differences between the signals? If yes, explain why the speech signals sound different based on the plots. If no, comment why you think the speech signals sound different. Further, comment on what the result would sound like if F were to increase from $F = 250\alpha$ Hz. Compute, analytically, the Fourier transform of $y(t) = s(t)cos(2\pi F0t)$ in terms of the Fourier transform of s(t) and explain the observation. Try: plotting the spectrum of the signals using the fft function and verify the claims.

Problem 5. (Signal Generation-1)
Create 5000 samples of two sinusoids of 200α Hz and 220α with a time resolution of 0.001s. Append them (to make a 1×5000 array), and write it into a *.wav* file. Listen to it and write down your observations.

Problem 6. (Signal Generation-2)
Generate a sequence containing the tones corresponding to *Do Re Mi Fa So La Ti Do*. Hint: Generate signals of the type $y(t) = sin(2\pi Ft)$, where F is the frequency that corresponds to each note. Append the signals together and save the resulting signal as a *.wav* file.

Problem 7. (Covolution)
Load the data *Track00*α*.wav*. Load the data from the text file *ConvFile*α*.txt* and then convolve the two data streams. Store the result into a *.wav* file. What do you observe? Can you guess the type of filter being used?

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