
# Zeroth Problem Assignment

## EE603 - DSP and its applications

Assigned on: August 21, 2020 Due on: August 28, 2020

**Notes:**

(1) Copying will be dealt with strictly. Institute disciplinary procedures will be invoked if any form of cheating is detected.

(2) All computer assignments should be solved using Python and submitted as a Colab notebook shared with the instructor and the TAs. The name of the file should be `ROLLNUMBER_HW0.ipynb`

(3) All question responses must be in the same sheet and shared with the TA with edit permissions.

### Problem 1

(10 points) What is the condition on $\omega_0$ for $e^{j\omega_0 n}$ to be periodic?

### Problem 2

(10 points) Plot the following sequences for $n = -8, -7, -6, ...6, 7, 8$ using stem plots. Label the axes, and ensure that the plots look neat.

(a) $\delta[n]$

(b) $u[n]$

(c) $\delta[n-2] + \delta[n-3]$

(d) $(0.9)^n u[n]$

(e) $(-0.9)^n u[n]$

(f) $\sin(0.5\pi n)/\pi n$ (take limits for $n = 0$)

### Problem 3

(10 points) Consider the sequence $x[n] = (0.9)^n u[n]$. If the values of this sequence are quantized using an 8 bit quantizer that takes values $0, 1/256, 2/256, ...255/256$ to obtain $\hat{x}[n]$, find the following:

(a) All $n$ for which $x[n] = \hat{x}[n]$

(b) Smallest value $n_0$ such that $\hat{x}[n] = 0$ for $n > n_0$

(c) The sum squared-error between $x[n]$ and $\hat{x}[n]$, defined as $\sum_n |x[n] - \hat{x}[n]|^2$.

## Problem 4

(10 points) Download the wave file from this URL: `https://commons.wikimedia.org/wiki/File:988-v04.lehman1.wav` and open it using the `scipy.io.wavfile.read` function.

(a) Plot the waveform using Matplotlib. Observe the variations of the waveform. What is the range of values that you observe?

(b) Scale all values down by half; remember to keep the data types intact. Use `scipy.io.wavfile.write` to save the file and listen to it. What do you observe? Make more changes to the waveform and listen to see how it is affected.