BLG354E
Homework-2

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- You should write all your code in Python language.
- For the mathematical questions, it is not necessary to use LaTeX etc. You can clearly write your answers on papers and scan them.
- Cheating is highly discouraged. If you are planning to use different libraries or functions, please ask me about it.

1 (15 pts) - DT Fourier Series Analysis

For some DT signals, equations representing one of their periods are given below. Determine the DTFS coefficients for these signals.

1. $$x[n] = [n + 2e^{3n}]u[n-2], -5 < n < 5, N = 9$$

2. $$y[n] = \begin{cases} n^2, & n < -3 \\ 0, & n \geq -3 \end{cases}, -6 < n < 6, N = 11$$

3. $$z[n] = \sum_{m=n-2}^{n+2} me^{xm}, -4 < n < 4, N = 7$$

2 (15 pts) - DT Fourier Series Synthesis

Using Python, reobtain the signals given in the first question from their DFTS coefficients. Plot the graphs using matplotlib.

3 (20 pts) - CT Fourier Series

For the CT signal $x(t) = 2sin(2\pi t) + 4cos(3\pi t)$, find the CTFS coefficients and reobtain the signals as in parts 1 and 2.

4 (20 pts) Fourier Transform

For the CT signals given below, find the Fourier Transform representations.

- $x(t) = e^{2t}u(-t)$
- $x(t) = e^{2|t|}$

5 (20 pts) Inverse Fourier Transform

Find the inverse Fourier transform for the following spectra.

- $X(\omega) = 3\delta(\omega - 4)$
- $X(\omega) = \pi e^{-|\omega|}$

6 (10 pts) Nightcore

Nightcore is a music genre where pitch of an original song is changed absurdly and its speed is increased by a value of 20%-30%[1]. This speed change can be done by linear interpolation.

Explore **librosa** library to obtain a Nightcore version of your favourite song!

[1]For a good example visit https://www.youtube.com/watch?v=_DPR2HRoK1w