Signals and Systems for Computer Engineering

Assignment #2

Assigned: April 13, 2021

Due: April 24, 2021, **23:59** (submit through Ninova)

- Your submission must include your code and report.
- In the report, briefly explain your solution and include your plots (if applicable).
- Use only the Python programming language.
- Please **write your full name** (first name and last name) and **Student ID** at the top of your solution.
- Please show ALL work. Answers with no supporting explanations or work will not receive any partial credit. Your homework is not just a final report of your results; we want to see your steps. Upload all your steps to get to the solution.
- Assignments are individual.
- Do not copy & paste anything from anywhere. Use your own words.
- **No late submissions** will be accepted. Do not send your solutions by e-mail. We will only accept files that have been uploaded to the official Ninova e-learning system before the deadline. Do not risk leaving your submission to the last few minutes.
- If you have any questions regarding the assignment, please e-mail **Enes Albay (albay@itu.edu.tr)**.

1- Impulse response of DT system is given as h[n]=[1, 0.5, 0.25, 0.125, 0.0625]

a) Find output of this system for the input signal $x[n]=n\cdot e^{-n}(u[n]-u[n-3])$
b) Find the discrete time transfer function of the system T(z)
c) Draw the block diagram of this system in canonical form for direct programming (also known as "Direct form II")
d) Write the pseudo code that simulates the system

2- Alphabet Stock Price (@Nasdaq GOOGL) variation is given in the attached excel file. Use and modify the Python program that you prepared for Assignment #1 for this question. Choose last 400 samples (days) of the data (closing price) and,

a) Draw the standardized data (z_i) when the data is framed as sequence of 5 consecutive values (5 days) and frames are shifted by one frame (5 days without overlapping) where $z_i = \frac{x_i - \mu}{\sigma}$, σ: standard deviation, μ: average of 5 days. (Totally 80 data frames, 400 data points)

b) Draw the min-max normalized data (x_n) when the data is framed as sequence of 5 consecutive values (5 days) and frames are shifted by one frame (5 days) (where $x_n = \frac{x_i - x_{min}}{x_{max} - x_{min}}$, x_{max} is the maximum of the framed data sequence).

c) Draw the graph of maximum convolution value between x[n] and h[n] (max(x[n]*h[n])) where x[n] is the normalized data sequence (5 days framed data sequences, 400 data points) in "b" and h[n] is any of below given sequences.

- h[n] = [0.2 0.4 0.6 0.8 1]
- h[n] = [0.8 0.6 0.4 0.2 0]

(Graphs will have 400 data points in "a" and "b", 80 data points in "c")