Habib University

EE/CE 453/352: Digital Signal Processing - Spring 2024
Saad Baig

Time = 30 minutes	**Quiz 01**	Max Points: 20

Instructions:

i. **Smart watches, laptops, and similar electronics are strictly NOT allowed.**

ii. **Answer sheets should contain all steps, working, explanations, and assumptions.**

iii. Attempt the quiz with black/blue ink.

iv. Print your name and HU ID on all sheets.

v. This is a closed-book examination but you are allowed a single-sided A4 sized cheat sheet.

vi. You are not allowed to ask/share your method or answer with your peers. The work submitted by you is solely your own work. Any violation of this will be the violation of HU Honor code and proper action will be taken as per university policy if found to be involved in such an activity.

CLO Assessment:

This quiz will assess students for the following course learning outcomes.

	Course Learning Outcome	**Learning Domain Level**
CLO 1	Analyze discrete-time signals and systems in time domain	Cog-4

Undertaking:

I hereby affirm that I have read the instructions. I am fully aware of the HU honor code and the repercussions of its violation, and hereby pledge that the work I am going to submit is clearly my own.

Signature: _____

Name: INSTRUCTOR SOLUTION _____ **HU ID:** _____

Question 1 [4 pts]: If the discrete time signal $x[n] = \{0, 0, 0, 3, 2, 1, -1, -7, 6\}$, then determine:

$$y[n] = x[2n - 3]$$

Solution:

$$y[n] = x[n - 3] = \{0,0,0,0,0,0,3,2,1,-1,-7,6\}, \qquad \text{delay of 3}$$

$$y[n] = x[2n - 3] = \{0,0,0,3,1,-7\}, \qquad \text{time scaling by 2}$$

Question 2 [8 pts]: Determine and justify whether the following system is causal and time invariant:

$$y[n] = x[5n]$$

Solution: System is non-causal and time-variant

For causality, system depends on past, present and future values:

$$y[-k] = x[-k] \ and \ y[k] = x[5k]$$

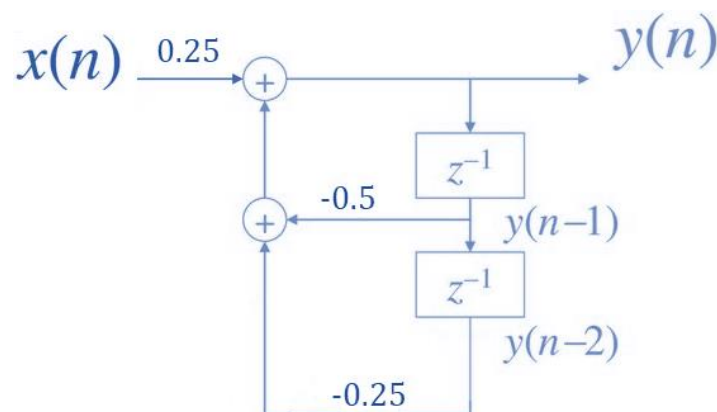For time-variance, the output due to the delayed input is not same as the delayed output:

$$y[n - k] = x[5(n - k)] \neq x[5n - k]$$

Question 3 [6 pts]: For the following system, where $y[n]$ is the output, draw the block diagram representation after rewriting the difference equation as needed:

$$y[n - 2] + 2y[n - 1] + 4y[n] = x[n]$$

Solution:

$$y[n] = \frac{1}{4}x[n] - \frac{2}{4}y[n - 1] - \frac{1}{4}y[n - 2]$$

Question 4 [2 pts]: For the following DT signal, find even ($x_e[n]$) and odd ($x_o[n]$) components:

$$x[n] = \{1, -3, 2\}$$

Solution:

$$x_e[n] = \{1, -1.5, 1, -1.5, 1\}$$

$$x_o[n] = \{-1, 1.5, 0, -1.5, 1\}$$