

Assignment 5: LTI Assignment

Rajdeep Gill 7934493

ECE 3760 A01

January 16, 2025

Q1

An LTI system is a Linear, Time-Invariant system. It follows the properties of linearity and time invariance. Linearity means the system is additive and homogeneous. Time invariance means the system's response to an input signal is independent of when the input signal is applied.

Q2

The system provided is a mapping as follows:

$$\begin{aligned}0 &\mapsto 5, \\1 &\mapsto 10, \\2 &\mapsto 15,\end{aligned}$$

Equivalently as a function:

$$y[n] = \begin{cases} 5, & \text{if } n = 0, \\ 10, & \text{if } n = 1, \\ 15, & \text{if } n = 2, \end{cases}$$

- Is it deterministic?

Yes, the output is deterministic as it is a one-to-one mapping. So we can determine the output for any given input and vice-versa.

- Is it linear?

The system is linear as it satisfies both the properties of additivity and homogeneity. The system is additive as the output for $n = 0$ is 5, for $n = 1$ is 10, and for $n = 2$ is 15. The system is homogeneous as the output is a scalar multiple of the input.

- Is it time invariant?

The system is time invariant as the output for a given input is independent of when the input is applied.

- Is it causal?

No, the system only provides an output for $n = 0, 1, 2$. It does not rely on future values of the input signal.

- Is it stable?

Yes, the system is stable as the output values are bounded for the 3 input values.

- Is it discrete?

Yes, the system is discrete as the input and output are discrete values.

- Is it memoryless?

Yes, the system is memoryless as the output is only dependent on the current input value.