

University of Nebraska-Lincoln

Digital Signal Processing: Assignment 1

Due Date: September 19, 2025

For each of the following input/output relations for a discrete time system, please indicate whether the system is:

L or NL: Linear or Not Linear

TI or NTI: Time Invariant or Not Time Invariant

C or NC: Causal or Not Causal

B or NB: BIBO Stable or Not BIBO Stable

If for any property it is not possible to say, then indicate this by writing **CBD** (Cannot Be Determined).

Input/Output Relation	L/NL	TI/NTI	C/NC	B/NB
$y[n] = 7x[n + 2]$	L	TI	NC	B
$y[n] = x[n] - 4x[n - 5] + 3x[n - 15]$	L	TI	C	B
$y[n] = \frac{x[n - 4]}{x[n] + 8}$	NL	TI	C	NB
$y[n] = x[n] + (x[n - 3])^{-1} + \cos(n + 4)$	NL	NTI	C	NB
$y[n] = \text{med}\{x[n + 2], x[n], x[n - 2]\}$	NL	TI	NC	B
$y[n] = x[1] + \sum_{k=-\infty}^n x[k]$	L	NTI	NC	NB
$y[n] = \frac{1}{5} \sum_{k=n-4}^{n+6} x[k]$	L	TI	NC	B
$y[n] = \sum_{k=0}^{\infty} h[k]x[n - 2k]$	L	TI	C	NB
$y[n] = \sum_{k=2}^{n+4} x[k] \left(\frac{3}{5}\right)^k$	L	NTI	NC	B
$y[n] = \sum_{k=3}^n x[k] \left(\frac{2}{k}\right) (-1)^k$	L	NTI	C	NB

Table 1: Classification of Input/Output Relations with Properties

Notes:

1. In our notation, if the upper limit of a summation is higher than or equal to the lower limit, a summation occurs; otherwise, the summation returns a zero.
2. Assume $|h[n]|$ is bounded for all n .
3. $\text{med}\{\}$ returns the median of three values – e.g., $\text{med}\{7, -3, 10\} = 7$.
4. Attach any work you did to obtain your answers. You can either show that the relation meets our definition, or show a counter-example that shows the relation does not.