Classwork 20
FA24
UAH
CPE 381
Instructor: Rahul Bhadani

Name of the Student:

Total Marks: 10 points

Q1. Remember infinite Geometric progression is written as

$$S_\infty = a + ar + ar^n + \cdots \qquad |r| < 1$$
$$= \frac{a}{1-r}$$

Now, consider a system:

$$y[n] = \frac{1}{3}(x[n+1] + x[n] + x[n-1])$$

(a) Is the system given by $y[n]$ causal? why or why not? (2.5 points)

The system is not causal because the present value of $y[n]$ depends on the future value of x.

(b) Is it BIBO stable? (2.5 points)

BIBO stability says that if the input is bounded output will be bounded.

Let say input $|x[n]| < M$. – it is bounded

So $$y[n] \leq \frac{1}{3}(M + M + M) = \frac{1}{M} \leq \infty$$

Hence the system is BIBO Stable.

Q2. Sampled signal can written as:

$$x(t) = \sum_n x(nT_s)\,\delta(t - nT_s)$$

(a) Knowing the delayed version of a signal result in a phase change (or a multiplication by complex exponential), write down the expression $X(s)$ where $X(s)$ is the Laplace transform of $x(t)$

Given $\mathcal{L}(\delta(t)) = 1$

$\mathcal{L}(x(t-A)) = X(s)e^{-As}$

(2.5 point)

$$X(s) = \sum_n x(nT_s)\mathcal{L}[\delta(t-nT_s)]$$

$$= \sum_n x(nT_s)e^{-nsT_s}$$

(b) In the expression of $X(s)$ you obtain, do variable substitution by assuming a new variable $z = e^{sT_s}$, and write $X(s)$ as a function of z. (2.5 points)

Solution: $X(s)\Big|_{z=e^{sT_s}} = X(z) = \sum_n x(nT_s)z^{-n}$