SFWRENG/MECHTRON 3MX3 Practice Questions 1

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1) Discrete Systems

The System S is given by:

$$y(n) = y(n-1) - x(n-1) + x(n)$$

We assume that $y(-1) = 0$.

1. Compute the output to the input $x(n) = \delta(n)$.
2. Compute the output to the input $x(n) = \delta(n) + \delta(n-1) + \delta(n-2)$.
3. Compute the output to the input $x(n) = \cos(\pi n)$.

2) Difference equations to State Space equation

Given the difference equation

$$y(n) = y(n-1) - y(n-2) + x(n) - x(n-2)$$

Determine the $[A, B, C, D]$ representation of the system.

3) $[A, B, C, D]$ representation

Given the system

$$y(n) = x(n) + x(n-2) - y(n-2)$$

1. Compute the $[A, B, C, D]$ representation
2. Use the state space equation to compute the output (5 values) to the input $x(n) = \delta(n)$.

4) Compound Interest

A bank account is just a system; $x(n)$ be the amount deposited or withdrawn (x negative) at day n, and α be the daily interest rate. Then the account balance is given by

$$y(n) = y(n-1) + \alpha y(n-1) + x(n)$$

How much money do you have after 10 days if you initially deposit \$100 ? (α is used as a symbolic parameter).