# SGN-1156 SIGNAL PROCESSING TECHNIQUES

## Exercise 1

## November 12, 2009

**PROBLEM 1:** Consider a system with the following input-output relationship:

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

where $x[n]$ is the input to the system and $y[n]$ is the system's output. Is this system linear? Is it time-invariant? Is it stable?. Could you determine the ouput of the system to an arbitrary input by using only the system's impulse response?. Justify your answers.

**PROBLEM 2:** Consider a system with the following input-output relationship:

$$y[n] = (n-1)^2 x[n]$$

where $x[n]$ is the input to the system and $y[n]$ is the system's output. Is this system linear? Is it time-invariant? Is it causal? Is it stable?

**PROBLEM 3:** Consider a system with the following input-output relationship:

$$y[n] = x[n] + 2x[n-5]$$

where $x[n]$ is the input to the system and $y[n]$ is the system's output. Is this system stable?

**PROBLEM 4 (problem 2.64 from the book):** Determine the expression for the impulse response of the LTI system in the figure below.
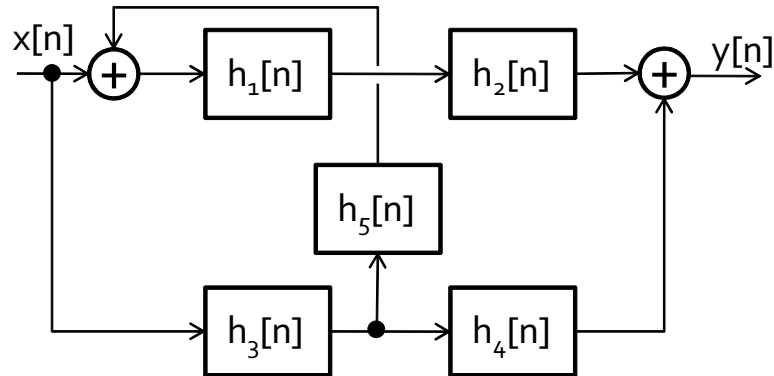


**PROBLEM 5 (problem 2.48 from the book):** A periodic sequence $\tilde{x}[n]$ with a period $N$ is applied as an input to an LTI discrete-time system characterized by an impulse response $h[n]$ generating an output $y[n]$. Is $y[n]$ a periodic sequence? If it is, what is its period?