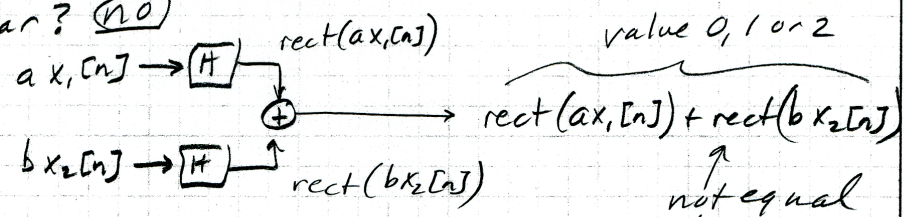
① Text, 5-5

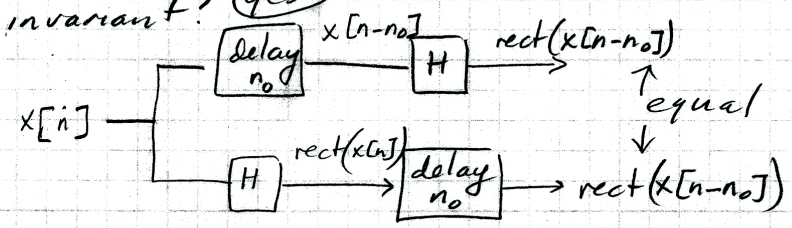
$y[n] = \text{rect}(x[n])$ note: this is the continuous rect function.

linear? no



$a x_1[n] + b x_2[n] \longrightarrow \boxed{H} \longrightarrow \underbrace{\text{rect}(a x_1[n] + b x_2[n])}_{\text{value 0 or 1}}$

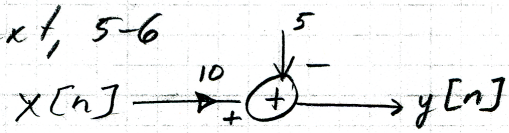
time invariant? yes



invertible? no

$y[n]$ will always have a value of 0 or 1. Given any $y[n]$ it cannot be mapped to a value of $x[n]$ that gave that output.

② Text, 5-6

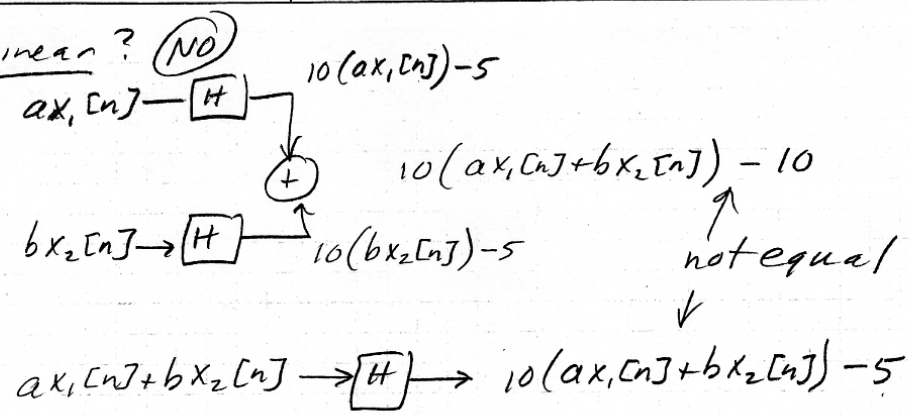


$y[n] = 10\,x[n] - 5$

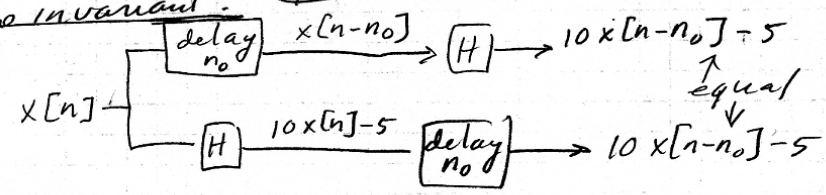
<u>static</u>? yes

output at time n only depends on input at time n (no future values)

linear? NO



time invariant? yes



invertible? yes

$$y[n] = 10x[n] - 5$$

$$x[n] = \frac{1}{10}(y[n]+5)$$

can uniquely determine the input value for any output value.

BONUS - Not a problem I'd expect you to do.

(3) *Text, 5-7 Note - This problem is unlike other problems we've seen because the output is a function of input and past

$$y[n] = 0.25(x[n] + y[n-1] - 2y[n-2])$$

outputs. This is more something we'd cover in EE 432

causal? yes - output at any time n_0 does not depend on any future values of input or output, only current and past values

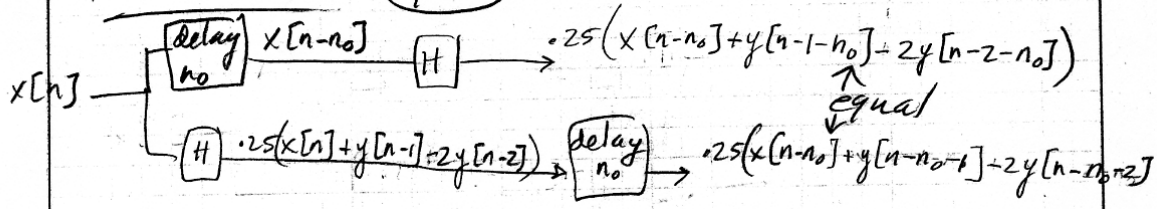
$y[n] = 0.25(x[n] + y[n-1] - 2y[n-2])$

Bibo stable? Yes

so $y[n] - 0.25y[n-1] + 0.5y[n-2] = 0.25x[n]$

assume $|x[n]| < M < \infty$

then $|y[n] - 0.25y[n-1] + 0.5y[n-2]| < 0.25M < \infty$

BIBO stable

time invariant? yes