

Consider a system  $H$  with excitation  $x[n]$  and response  $y[n]$  related by  $y[n] = x[n](g[n] + g[n-1])$

(a) If  $g[n] = 1$  for all  $n$ , show that  $H$  is time invariant

In this case  $y[n] = 2x[n]$

Let  $x_1[n] = g[n] \rightarrow y_1[n] = 2g[n]$

Let  $x_2[n] = g[n-n_0] \rightarrow y_2[n] = 2g[n-n_0] = y_1[n-n_0]$

$\Rightarrow$  time invariant

(b) If  $g[n] = n$ , show that  $H$  is not time invariant

In this case  $y[n] = x[n](n + n-1) = (2n-1)x[n]$

Let  $x_1[n] = g[n] \rightarrow y_1[n] = (2n-1)g[n]$

Let  $x_2[n] = g[n-n_0] \rightarrow y_2[n] = (2n-1)g[n-n_0]$

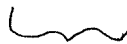
$\Rightarrow$  not time invariant  $\neq y_1[n-n_0]$

(c) If  $g[n] = 1 + (-1)^n$ , show that  $H$  is time invariant

In this case  $y[n] = x[n](1 + (-1)^n + 1 + (-1)^{n-1})$

This is +1 for n-even and -1 for n-odd  $\uparrow$  This is -1 for n-even and +1 for n-odd  $\uparrow$  they cancel!

$y[n] = 2x[n]$



Time invariant, see part (a)