

EE 3054 QUIZ 1 FALL 2007

SHOW YOUR WORK / SIMPLIFY YOUR ANSWERS / NO GRAPHING CALC.

① Make a sketch of each of the following <sup>discrete-time,  $n \in \mathbb{Z}$</sup>  signals

① a  $f(n) = 3\delta(n-1) - 2\delta(n-3)$

① b  $g(n) = \sum_{k=0}^{\infty} (-\frac{1}{2})^k \delta(n-2k)$

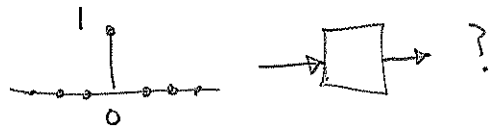
① c  $x(n) = 2\cos(\frac{\pi}{2}n)u(n-2)$

① d  $v(n) = \cos(2\pi n)u(n)$

② A discrete-time system is described by:

$$y(n] = x[n] - n \cdot x[n-1]$$

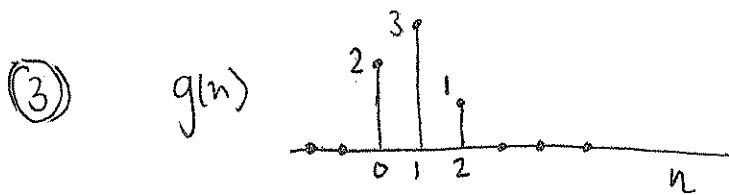
a find the output produced by the input  $\delta[n]$



b classify the system as linear/nonlinear

c " " " " TimeInvariant/non-TI.

d " " " " stable/unstable



- a) sketch the signal  $x(n)$  defined thru  $X(z) = z^{-2} G(z)$   
 b) " " "  $f(n)$  " "  $F(z) = G(z^2)$   
 c) " " "  $v(n)$  " "  $V(z) = G(-z)$
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④ IF the transfer function of an LTI system is

$$H(z) = 3z^{-2}$$

write down the diff. eq. that implements the system  
 & sketch its impulse response

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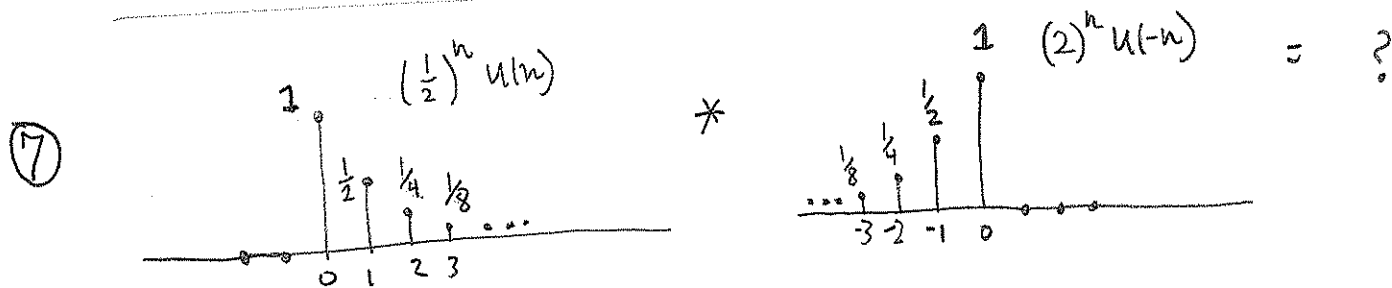
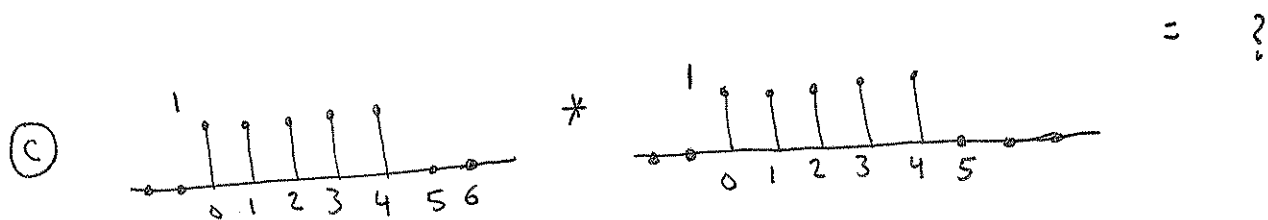
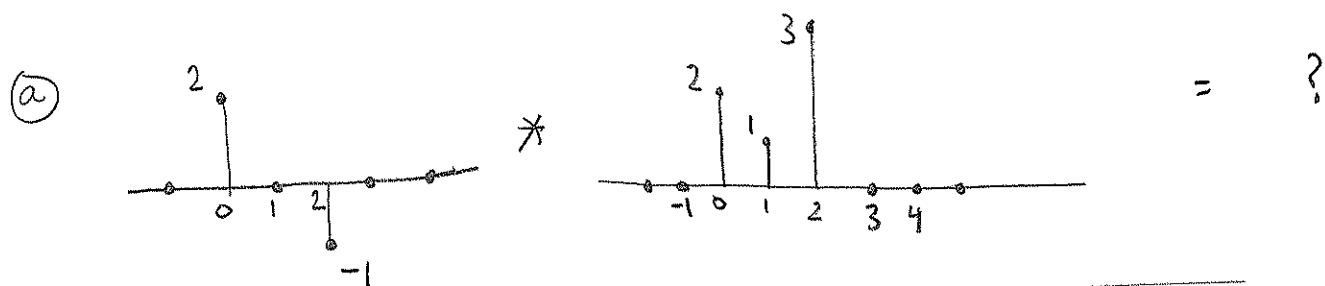
⑤ IF the diff. eq. is

$$y(n] = x(n) + 0.2x(n-2) - 0.4y(n-1)$$

what is the transfer function of the system?

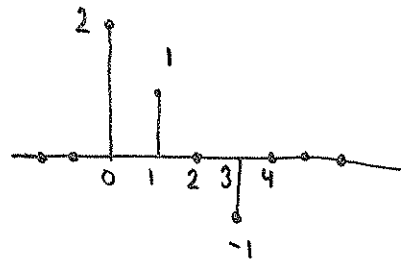


⑥ Find the convolution of the following signal pairs



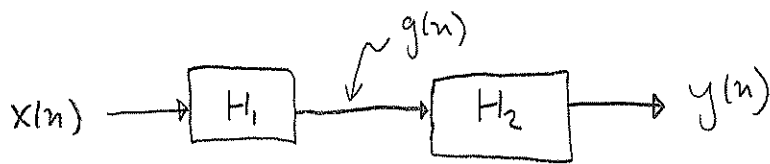
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$x(n) = 3$ , impulse response:



find/sketch output signal  $y(n)$

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LTI SYSTEM  $H_1$  is described by the difference eq:

$$g(n) = 2x(n) + x(n-1]$$

$H_2$  is descr. by diff. eq:

$$y(n) = g(n) - \frac{1}{2} y(n-1]$$

Find the diff. eq. for the total system:

$$y(n) = \quad ?$$

RHS should use  $x$  &  $y$ .

some formulas

name	formula
convolution	$(f * g)(n) = \sum_k f(k)g(n-k)$
transfer function	$H(z) = \sum_n h(n)z^{-n}$
frequency response	$H^f(\omega) = \sum_n h(n)e^{-j\omega n}$ ← no needed today
Euler's formula	$e^{j\theta} = \cos(\theta) + j \sin(\theta)$
... for cosine	$\cos(\theta) = \frac{e^{j\theta} + e^{-j\theta}}{2}$
... for sine	$\sin(\theta) = \frac{e^{j\theta} - e^{-j\theta}}{2j}$

Z-transform transform pairs

$x(n)$	$X(z)$	ROC
$x(n)$	$\sum_n x(n)z^{-n}$ (def.)	
$a^n u(n)$	$\frac{z}{z-a}$	$ z  >  a $

ALSO

$$1 + a + a^2 + a^3 + \dots = \frac{1}{1-a}$$