ECE 3510 homework # Z1 Due:

A.Stolp
4/13/06
b

1. Problem 6.1 (p.215) in the Bodson text. Find $x(0)$ if the z-transform of $x(k)$ is

   a) $X(z) = \dfrac{a\cdot z - 1}{z - 1}$ b) $X(z) = \dfrac{z}{z^2 - a\cdot z + a^2}$

2. Problem 6.3 in the text. Use partial fraction expansions to find the $x(k)$ whose z-transform is

   a) $X(z) = \dfrac{1}{(z-1)\cdot(z-2)}$ b) $X(z) = \dfrac{z}{z^2 - 2\cdot z + 2}$

3. Problem 6.4 in the text. Sketch the time function $x(k)$ that you would associate with the following poles. Only a sketch is required, but be as precise as possible.

   a) $p_1 = 0.9\cdot j$, $= -0.9\cdot j$ b) $p_1 = 1$, $p_2 = -1$ c) $p_1 = 0.3$, $p_2 = 0.9$ d) $p_1 = e^{j\cdot\frac{\pi}{6}}$, $p_2 = e^{-j\cdot\frac{\pi}{6}}$

4. Problem 6.6 (p.217) in the Bodson text.
5. Problem 6.7 in the text.

homework # Z2 Due:

1. Problem 6.8 in the text
2. Problem 6.9 in the text
3. Problem 6.10 in the text b) hint: find y(k) by partial fraction expansion, then $\dfrac{y(k)}{y(k-1)}$ and then let k -> ∞ .
4. Problem 6.11 (p.219) in the Bodson text.
5. Problem 6.12 in the text.
   Hints: $r(k) = r\cdot u(k)$ Find $\dfrac{e(z)}{R(z)}$ and make sure its poles are inside unit circle

homework # Z3 Due:

May be handed in with final for full credit

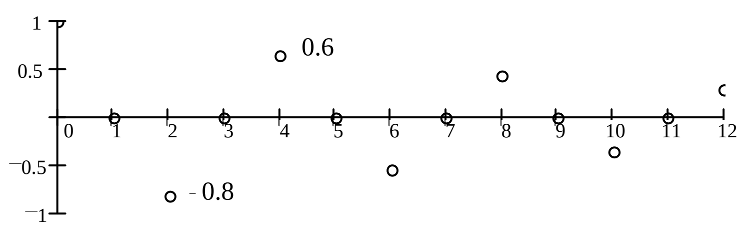
1. Problem 7.1 (p.253) in the Bodson text.
2. Problem 7.2 in the text

<u>Z1 Answers</u>

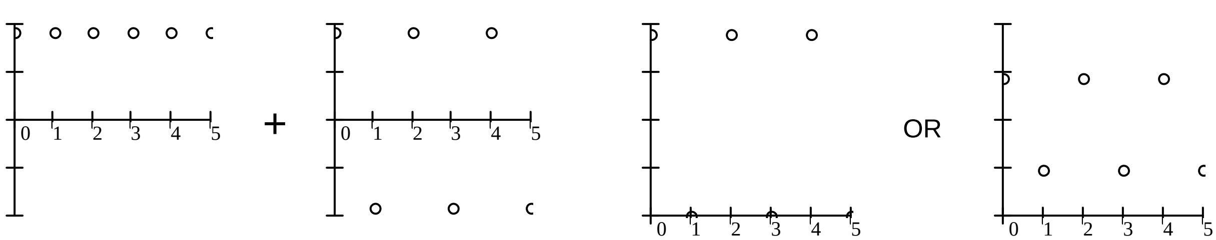
1. a) a b) 0 2. a) $\frac{1}{2}\cdot\delta(k) - 1 + \frac{1}{2}\cdot 2^k$ b) $\left(\sqrt{2}\right)^k\cdot\sin\left(\frac{\pi}{4}\cdot k\right)$

3. Actual signals may have different magnitudes and/or phase angles. You can't tell those things from the pole locations.

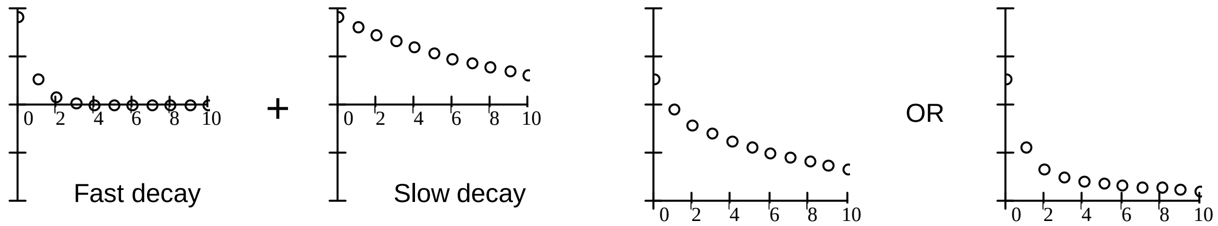
   a) $x(k) = 0.9^k\cdot\cos\left(\frac{\pi}{2}\cdot k\right)$



   b)

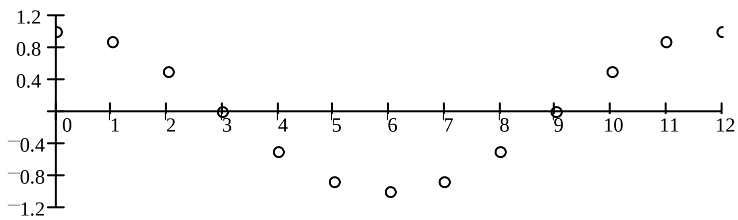


Or many others, depending on relative magnitudes c)



Or many others, depending on relative magnitudes

d) $x(k) = \cos\left(\frac{\pi}{6}\cdot k\right)$



4. (6.6) a) $x(k) := -4\cdot\delta(k) + 2 + 2\cdot\sqrt{2}\cdot\cos\left(\frac{\pi}{2}\cdot k + \frac{\pi}{4}\right)$

$x(0) = 0$ $\quad x(1) = 0$ $\quad x(2) = 0$ $\quad x(3) = 4$ $\quad x(4) = 4$ $\quad x(5) = 0$ $\quad x(6) = 0$ $\quad x(7) = 4$ $\quad x(8) = 4$

5. (6.7)

	Bounded	Converges	$x(\infty)$	
a)	yes	yes	0	
b)	yes	yes	0	vanishes in a finite time (all poles are at zero)
c)	yes	no		
d)	yes	yes	8/9	
e)	yes	yes	2	
f)	no			
g)	yes	no		
h)	yes	yes	1	

Z2 Answers

1. (6.8) a) yes
   b) yes
   c) no
   d) yes
   e) no
   f) yes

2. (6.9) a) $H(z) = \frac{z^2}{z^2 - a\cdot z + a^2}$ stable if: $|a| < 1$

   b) $H(z) = \frac{12\cdot z^2 + 48\cdot z - 3}{z\cdot(2\cdot z - 1)}$ stable

3. (6.10) a) $H(z) = \frac{z^2}{z^2 - z - 1}$ unstable b) $\frac{1+\sqrt{5}}{2} = 1.618$

4. (6.11) a) gain = $-\frac{2}{3}$ $\quad y_{ss} = -2$ $\quad$ b) $2\cdot e^{j\cdot\frac{\pi}{2}}$ (frequency response) $\quad -2\cdot\sin\left(\frac{\pi}{2}\cdot k\right)$

5. (6.12) $a = 1$ $\quad g < 1$

Z3 Answers

1. (7.1) a) $H_d(z) = \frac{z\cdot\left(T - 1 + e^{-T}\right) + \left(1 - e^{-T} - T\cdot e^{-T}\right)}{(z-1)\cdot\left(z - e^{-T}\right)}$ $\quad$ b) $H_d(z) = \frac{(1-\cos(T))\cdot(z+1)}{z^2 - 2\cdot\cos(T)\cdot z + 1} = 0$ @ $T = 2\cdot\pi$

2. (7.2) $60\cdot Hz$