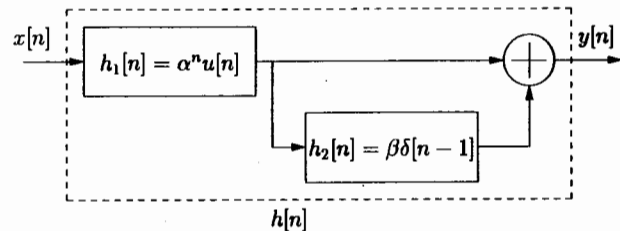


Assignment Quiz 5
November 5, 2001

Instructor: B.L. Daku
Time: 15 minutes
Aids: None

Name:
Student Number:

1. Given the following system, where $|\alpha| < 1$,



- Directly, find the impulse response $h[n]$ of the overall system. (Do not use the frequency response to find $h[n]$.)
- Is this system causal? Why or why not?
- Find the frequency response of the overall system.
- Specify a difference equation that relates the output $y[n]$ to the input $x[n]$.

a) $h_1[n] = \alpha^n u[n]$
 $h_2[n] = \beta \delta[n-1]$
 $h[n] = h_1[n] + h_2[n]$
 $= h_1[n] + h_2[n]$
 $= \sum \alpha^n u[n] \beta \delta[n-1] + \sum \alpha^n u[n]$
 $h[n] = \alpha^n u[n] \beta + \alpha^n u[n]$
 $h[n] = \beta \alpha^{n-1} u[n-1] + \alpha^n u[n]$

$\alpha^n u[n] = \frac{1}{1 - \alpha e^{j\omega}}$

$\beta \delta[n-1] = \frac{1}{1 - \alpha e^{j\omega}}$

Zeros	Poles
$1 + \frac{3}{2} = 0$	$z = 0$
$1 - \frac{3}{2} = 0$	$1 - \frac{1}{3} z = 0$
$z = -3$	$1 = \frac{1}{3} z$
$1 + \frac{2}{2} = 0$	$1 - \frac{2}{2} = 0$
$1 = -\frac{2}{2}$	$1 = \frac{2}{2}$
$z = -2$	$z = 2$
	$1 - \frac{3}{2} = 0$
	$1 = \frac{3}{2}$
	$z = 3$

b) when $n < 0$ system is zero cause $h[n]$ is zero
yes system is causal ✓

c) $H(e^{j\omega}) = \left(\frac{\beta}{\alpha} \right) \left(\frac{1}{1 - \alpha e^{-j\omega}} \right) + \left(\frac{1}{1 - \alpha} \right)$
 $= \frac{\beta}{\alpha} \frac{1}{1 - \alpha e^{-j\omega}} + \frac{1}{1 - \alpha}$
 $= \frac{\beta - \alpha \beta + \alpha - \alpha^2 e^{-j\omega}}{1 - \alpha e^{-j\omega}}$

Assignment Quiz 6
November 14, 2001

Instructor: B.L. Daku
Time: 10 minutes
Aids: None

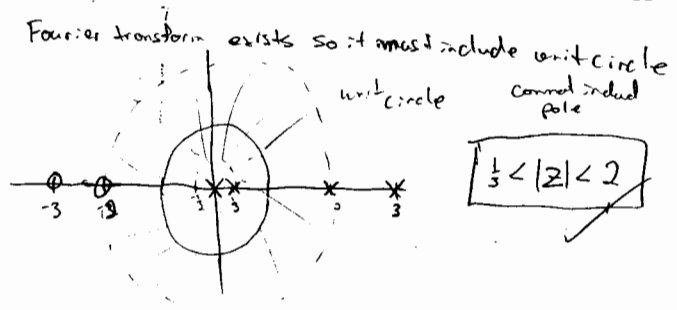
Name:
Student Number:

1. Given the z-transform,

$$X(z) = \frac{z^{-1}(1 + 5z^{-1} + 6z^{-2})}{(1 - \frac{1}{3}z^{-1})(1 - 2z^{-1})(1 - 3z^{-1})}$$

- Determine the ROC of $X(z)$ if it is known that the Fourier transform exists. For this case, determine whether the corresponding sequence $x[n]$ is right-sided, left-sided or two-sided?
- How many possible two-sided sequences does $X(z)$ have?
- Is it possible for $X(z)$ to be associated with a sequence that is both stable and causal? If so, give the appropriate ROC. If not, explain why not?

a) $X(z) = \frac{(1 + 5z^{-1} + 6z^{-2})}{z(1 - \frac{1}{3}z^{-1})(1 - \frac{2}{3}z^{-1})(1 - \frac{3}{2}z^{-1})} = \frac{(1 + \frac{5}{z})(1 + \frac{2}{z})}{z(1 - \frac{1}{3}z^{-1})(1 - \frac{2}{3}z^{-1})(1 - \frac{3}{2}z^{-1})}$



b) $\frac{1}{3} < |z| < 2$

c) No, for it to be stable it must include the unit circle, and for it to be causal $|z| > 3$ in this case, so it cannot happen