Quiz-1 (CLO-1)
BEE-12C
DSP

Name: Solution

1) What is the z-transform of finite duration signal $x[n] = [2, 4, 5, 7, 0, 1]$? Assume $x[-2] = 2$, signal starting point and so on. [3 marks]

$$x(n) = 2\delta(n+2) + 4\delta(n+1) + 5\delta(n) + 7\delta(n-1) + \delta(n-3)$$

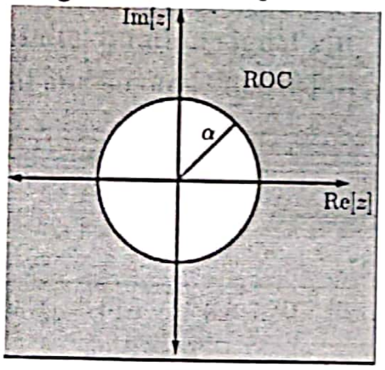
$$X(z) = 2z^2 + 4z + 5 + 7z^{-1} + z^{-3}$$

2) What is the ROC of signal $x[n] = \delta[n-k], k > 0$? [2 marks]

$$X(z) = \sum_{n=-\infty}^{\infty} x(n) z^{-n} = \sum_{n=-\infty}^{\infty} \delta(n-k) z^{-n}$$

$$= z^{-k} = 1/z^k \Rightarrow \text{Entire z-plane except origin}$$

3) Estimate the signal with ROC given [3 marks]



Basic form

$$X(z) = \frac{1}{1-\alpha z^{-1}} \cdot \frac{1}{z}$$

or.

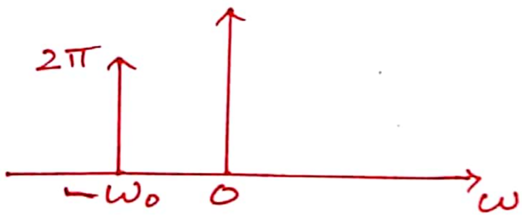
$$X(z) = \frac{1}{z-\alpha} = \frac{1}{z}\left[\frac{z}{z-\alpha}\right]$$

$$X(z) = z^{-1}\left(\frac{z}{z-\alpha}\right)$$

$$= \alpha^{n-1} u(n-1)$$

$$|z| > |\alpha|$$

4) Sketch the magnitude of the DTFT of $x[n] = cos(\omega_0 n) + sin(\omega_0 n)$ [2 marks]



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Quiz-1 (CLO-1)

BEE-12D

DSP

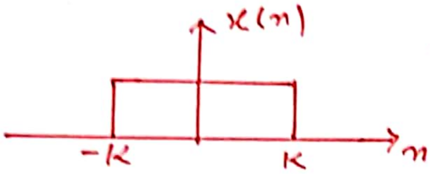
Name: Solution

1) What is the z-transform of finite duration signal $x[n] = [2, 4, 5, 7, 0, 1]$? Assume $x[-3] = 2$, signal starting point and so on. [3 marks]

$x(n) = 2\delta(n+3) + 4\delta(n+2) + 5\delta(n+1) + 7\delta(n) + 2\delta(n-2)$

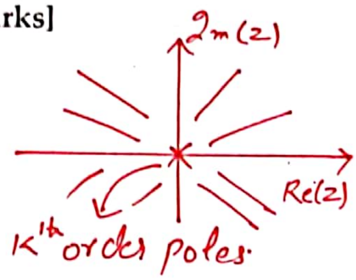
$X(z) = 2z^3 + 4z^2 + 5z + 7 + 2z^{-2}$

2) What is the ROC of signal $x[n] = u[n + k] - u[n - k]$, $k > 0$? [2 marks]

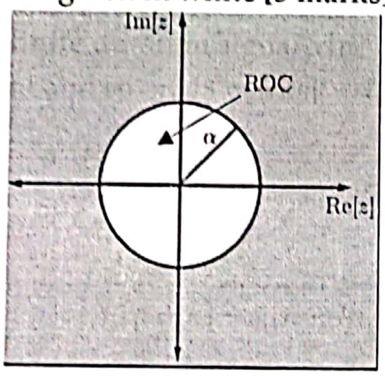


$X(z) = \frac{1}{z^k}\left[\frac{z^{2k+1} - 1}{z-1}\right]$

$\therefore$ Entire z-plane except origin



3) Estimate the signal with ROC given in white [3 marks]



$x(n) = \alpha^n u(-n) +$ Compensate for no zeros.

$X(z) = \frac{1}{z-\alpha}$

$= z^{-1}\left[\frac{z}{z-\alpha}\right]$

$x(n) = \alpha^{n-1} u(-n+1)$

4) Sketch the DTFT of $x[n] = cos(\omega_0 n) + jsin(\omega_0 n)$. Hint: Assumed DTFT for $\cos(\omega_0 n)$ as $X(e^{j\omega}) = \pi\delta(\omega - \omega_0) + \pi\delta(\omega + \omega_0)$ for one period. [2 marks]