

Homework 6

Hani Mehrpouyan

QUESTION 1 (5 POINTS)

Write a Matlab program to compute the circular convolution of two Length-N sequences via the DFT-based approach.

Using this program, determine the circular convolution of the following pair of sequences:

- 1) $g[n] = \{5, -2, 2, 0, 4, 3\}$ and $h[n] = \{3, 1, -2, 2, -4, 4\}$.
- 2) $x[n] = \{2 - j, -1 - 3j, 4 - 3j, 1 + 2j, 3 + 2j\}$ and $v[n] = \{-3, 2 + 4j, -1 + 4j, 4 + 2j, -3 + j\}$
- 3) $x[n] = \cos(\pi n/2)$ and $y[n] = 3^n, 0 \leq n \leq 4$

QUESTION 2 (5 POINTS)

Show that for a causal sequence $x[n]$ defined for $n \geq 0$ and with z -transform $X(z)$,

$$x[0] = \lim_{z \rightarrow \infty} X(z)$$

The above results is known as the initial value theorem.

QUESTION 3 (5 POINTS)

Consider the following sequences

- 1) $x_1 = (.03)^n \mu[n + 1]$,
- 2) $x_2[n] = (0.7)^n \mu[n - 1]$,
- 3) $x_3[n] = (0.4)^n \mu[n - 5]$,
- 4) $x_4[n] = (-0.4)^n \mu[-n - 2]$,

- 1) Determine the ROCs of the z -transform of each of the above sequences.
- 2) From the ROCs determine in Part (a), determine the ROCs of the following sequences

- a) $y_1 = x_1[n] + x_2[n]$,
- b) $y_2 = x_1[n] + x_3[n]$,
- c) $y_3 = x_1[n] + x_4[n]$,
- d) $y_4 = x_2[n] + x_3[n]$,
- e) $y_5 = x_2[n] + x_4[n]$,
- f) $y_6 = x_3[n] + x_4[n]$,

QUESTION 4 (5 POINTS)

Determine the z -transform of each of the following sequences and their respective ROCs. Assume $|\beta| > |\alpha| > 0$.

Show their pole-zero plots and indicate clearly the ROC in these plots.

$$1) x_1[n] = (\alpha^n + \beta^n)\mu[n + 2],$$

$$2) x_2[n] = \alpha^n\mu[-n - 2] + \beta^n\mu[n - 1],$$

$$3) x_3[n] = \alpha^n\mu[n + 1] + \beta^n\mu[-n - 2],$$

QUESTION 5 (5 POINTS)

Each of the following z -transforms has three ROCs. Evaluate the z -transform corresponding to each ROC.

$$X_a(z) = \frac{3z}{z^2 + 0.3z - 0.18}$$

$$X_b(z) = \frac{3z^2 + 0.1z + 0.87}{(z + 0.6)(z - 0.3)^2}$$