UNIVERSITY OF CALIFORNIA, RIVERSIDE
Department of Electrical and Computer Engineering

WINTER 2025

EE110B-SIGNALS AND SYSTEMS

HOMEWORK 5

Please turn in by Monday, February 24th, 2025, 11:59pm.

Problem 1:
Determine the signal $x[n]$ whose DTFT is given by

$$X(e^{j\omega}) = \begin{cases} 3j & 0 < \omega \leq \pi \\ -3j & -\pi < \omega \leq 0 \end{cases}$$

in the interval $-\pi \leq \omega < \pi$.

Problem 2:
Let

$$h[n] = \begin{cases} \frac{\sin(\frac{\pi}{2}n)}{\pi n} & n \neq 0 \\ \frac{1}{2} & n = 0 \end{cases}$$

be the impulse response of an LTI system. Determine the output of the system to the input

$$x[n] = \begin{cases} \frac{\sin(\frac{\pi}{4}n)}{\pi n} & n \neq 0 \\ \frac{1}{4} & n = 0 \end{cases}$$

using the convolution property of the DTFT.

Problem 3:
Let $h[n] = 0.5^n u[n]$ be the impulse response of an LTI system. Determine the output of the system to the input $x[n] = u[-n]$ using the convolution property of the z-transform.

Problem 4:
Determine the z-transform of each of the following signals. Sketch the pole-zero plot and indicate the region of convergence. Indicate whether or not the Fourier transform of the signal exists.
a) $x[n] = (-1)^n u[n]$
b) $x[n] = 4^n \cos\left(\frac{2\pi}{6}n + \frac{\pi}{4}\right) u[-n-1]$
c) $x[n] = \delta[n+1] - \delta[n-1]$
d) $x[n] = 2^n u[-n] + \left(\frac{1}{4}\right)^n u[n-1]$
e) $x[n] = a^n(u[n] - u[n-10])$.