UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Department of Electrical and Computer Engineering

ECE 310 DIGITAL SIGNAL PROCESSING – FALL 2023

Homework 5

Profs. Do, Moustakides, Snyder   **Due: Sunday, Oct 1, 2023 on Gradescope**

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1. Compute the discrete-time Fourier transform (DTFT) of the following sequences:

    (a) $\{x[n]\} = \{\underset{\uparrow}{1}, -1\}$

    (b) $x[n] = u[n] - u[n-5]$, where $u[n]$ is the step sequence.

    (c) $x[n] = \sin(\pi n/4)$

    (d) $x[n] = \alpha^n \cos(\omega_0 n) u[n]$, where α and ω_0 are real constants with $|\alpha| < 1$.

2. The signal $\{x[n]\} = \{1, 2, \underset{\uparrow}{3}, 2, 1\}$ has the DTFT $X_d(\omega)$. Find the following quantities without explicitly computing $X_d(\omega)$:

    (a) $X_d(0)$

    (b) $X_d(\pi)$

    (c) $\angle X_d(\omega)$

    (d) $\int_{-\pi}^{\pi} X_d(\omega) d\omega$

    (e) $\int_{-\pi}^{\pi} |X_d(\omega)|^2 d\omega$