Exercises Week 11

DSP

1. Find the DFT coefficients of the periodic signal with period $\{1, 1, 0, 0\}$, and write the signal as a sum of sinusoidal components.
2. Find the DTFT of the signal $\{1, 1, 0, 0\}$, considering it is surrounded with infinitely-long zeros on both sides
3. A signal $x[n]$ has a Z transform with one pole $p_1 = -0.5$ and one zero $z_1 = 0.9$. It is known that at $\omega = \pi$, the modulus of the Fourier transform is $|X(\omega = \pi)| = 1$.

    a. Find the signals's Z transform $X(z)$
    b. Compute the expression of $|X(\omega)|$ and $\angle X(\omega)$
    c. Find the values $|X(\frac{\pi}{2})|$, $|X(\frac{-\pi}{2})|$ and $|X(0)|$
    d. Sketch $|X(\omega)|$

4. Design the pole-zero plot of a signal with:

    - low frequency content
    - frequency content around the frequency $\omega = \frac{\pi}{2}$