

# Exercises Week 10

## 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  $\omega = \frac{\pi}{2}$