Digital Signal Processing

http://kom.aau.dk/~zt/cources/DSP/

Exercises of Lecture 2 (MM2)

Exercise 2.1. The Fourier transform $X(e^{j\omega}) = \dfrac{1}{1-ae^{-j\omega}}$, $with -1 < a < 0$.

a) What is the value of $\mathrm{Re}\{X(e^{j\omega})\}$ - the real part of $X(e^{j\omega})$?

b) What is the value of $\mathrm{Im}\{X(e^{j\omega})\}$ - the imaginary part of $X(e^{j\omega})$?

c) What is the value of $\left|X(e^{j\omega})\right|$?

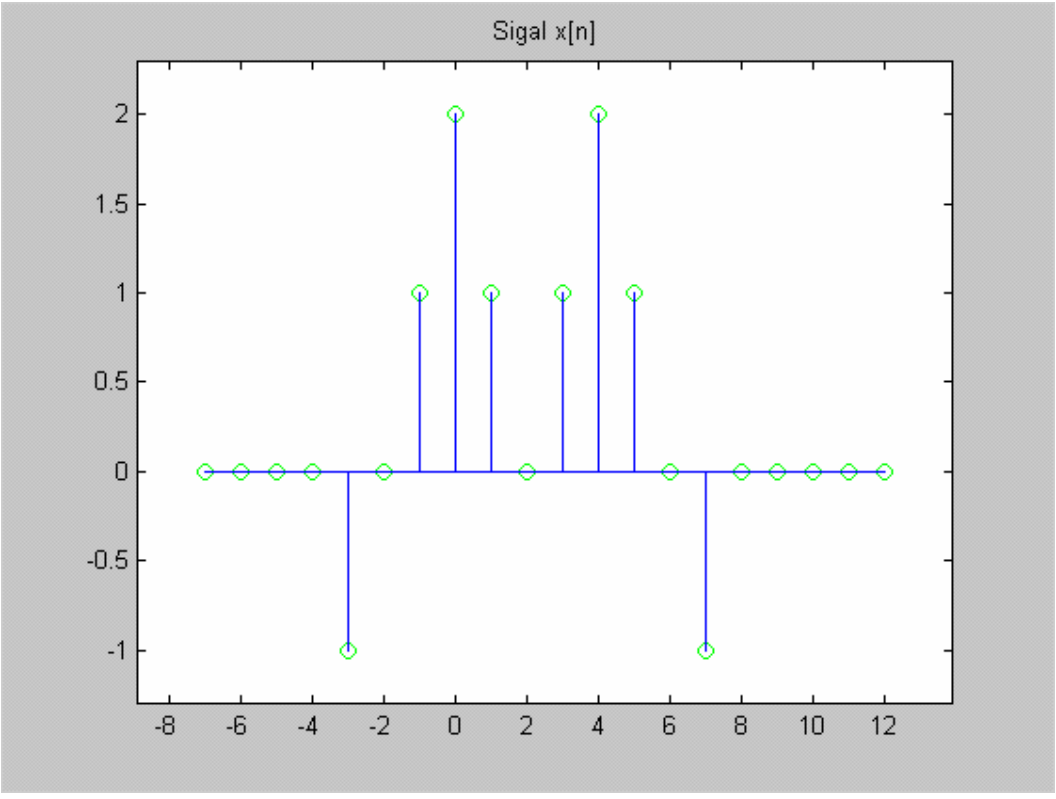
d) What is the value of $\angle X(e^{j\omega})$?

Exercise 2.2. Let $X(e^{j\omega})$ denote the Fourier transform of $x[n]$.

a) Using the definitions for the Fourier transform or its inverse, what is the Fourier transform of $x^*[n]$ (the complex conjugate of $x[n]$) ?

b) Using the definitions for the Fourier transform or its inverse, what is the Fourier transform of $x^*[-n]$?

Exercise 2.3. Let $X(e^{j\omega})$ denote the Fourier transform of the signal $x[n]$shown in the figure below. What is the value of $\left|X(e^{j\omega})\right|_{\omega=0}$?



Exercise 2.4. Imagine an ideal low-pass filter, $H(e^{j\omega})$, with cut-off frequency ω_c. If the output sequence, for some input, is given by

$$y[n] = \begin{cases} 1, 0 \le n \le 6 \\ 0, otherwise \end{cases},$$

what is the only possible value of ω_c?

Exercise 2.5. What is the frequency response, $H(e^{j\omega})$, of the 11-point moving, or running, averager:

$$y[n] = \frac{1}{11}\sum_{k=0}^{10} x[n-k]$$