Seminar 5

A pure tone \( x(t) = \cos(2\pi \omega_0 t) \), is sampled at a regular interval of time \( t = nT_s \) to produce the digital signal \( x[n] = x(nT_s) \).

1. How large must the sampling rate \( \omega_s = T_s^{-1} \) be in order to fully recover the signal from its samples?

2. Assume \( \omega_s = 8\omega_0 \). What is the period of \( x[n] \)?

3. Recall the definition of the discrete fourier transform (DFT) of a vector. Calculate the DFT of the vector \( x = \{x[0], x[1], \ldots, x[N-1]\} \), where \( N \) is the period of \( x[n] \).