Digital Communication and Signal Processing 2024

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Seminar 5

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

1. How large must the sampling rate $\omega_s = \mathrm{T_s}^{-1}$ 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 $x = \{x[0], x[1] \dots, x[N-1]\}$, where N is the period of $x[n]$.