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EN1060 SIGNALS AND SYSTEMS: TUTORIAL 04 *

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1. A discrete-time periodic signal $x[n]$ is real valued and has a fundamental period $N = 5$. The nonzero Fourier series coefficients for $x[n]$ are

$$a_0 = 1, a_2 = a_2^* = e^{j\pi/4}, a_4 = a_4^* = 2e^{j\pi/3}.$$

   Express $x[n]$ in the form

$$x[n] = A_0 + \sum_{k=1}^{\infty} A_k \sin(\omega_k n + \phi_k)$$

2. Use the discrete-time Fourier series analysis equation to evaluate the numerical values of one period of the Fourier series coefficients of the periodic signal

$$x[n] = \sum_{m=-\infty}^{\infty} \{4\delta[n-4m] + 8\delta[n-1-4m]\}$$

3. Let $x[n]$ be a real and odd periodic signal with period $N = 7$ and Fourier coefficients a_k. Given that

$$a_{15} = j, a_{16} = 2j, a_{17} = 3j,$$

   determine the values of a_0, a_1, a_{-2}, and a_{-3}.

4. Suppose we are given the following information about a signal $x[n]$:

   (a) $x[n]$ is a real and even signal.

   (b) $x[n]$ has period $N = 10$ and Fourier coefficients a_k.

   (c) $a_{11} = 5$.

   (d) $\frac{1}{10}\sum_{n=0}^{9} |x[n]|^2 = 50$.

   Show that $x[n] = A\cos(Bn + C)$, and specify numerical values for the constants A, B, and C.

*All the questions are from Oppenheim *et al.* chapter 4.