Signals and Systems – Spring 2024

Problem Set 6

Issued: May. 14th, 2024 Due: : May. 21th , 2024

Reading Assignment:

Chap. 3 - 5

Problem 1： OWN Problem 3.49

Problem 2： OWN Problem 3.58

Problem 3： OWN Problem 4.25

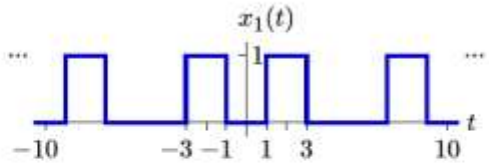
Problem 4： OWN Problem 4.37

Problem 5： OWN Problem 5.19

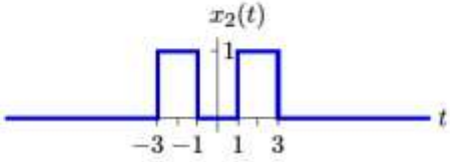
Problem 6： OWN Problem 5.34

Problem 7：

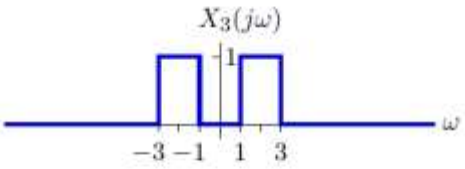
a. Determine the Fourier series coefficients of the following signal, which is periodic in $T = 10$.



b. Determine the Fourier transform of the following signal, which is zero outside the indicated range.



c. Determine the time waveform that corresponds to the following Fourier transform, which is zero outside the indicated range.



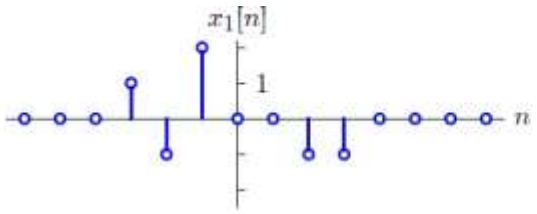
What is the relation between the answer to this part and that of the previous part?

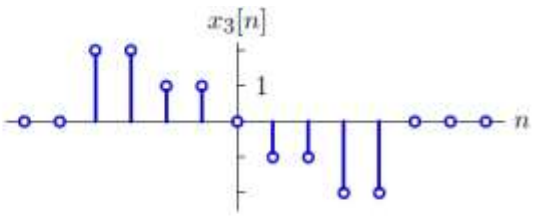
Problem 8:

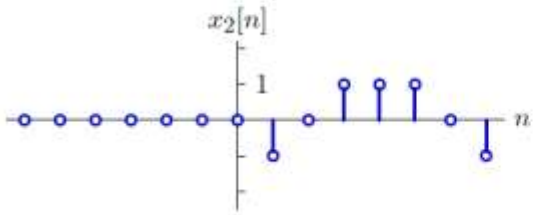
Which are True?

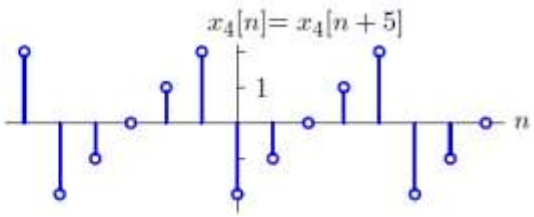
For each of the DT signals $x_1[n]$ through $x_4[n]$ (below), determine whether the conditions listed in the following table are satisfied, and answer **T** for true or **F** for false.

	$x_1[n]$	$x_2[n]$	$x_3[n]$	$x_4[n]$
$X(e^{j0}) = 0$				
$\int_{-\pi}^{\pi} X(e^{j\Omega})\, d\Omega = 0$				
$X(e^{j\Omega})$ is purely imaginary				
$e^{jk\Omega}X(e^{j\Omega})$ is purely real for some integer k				



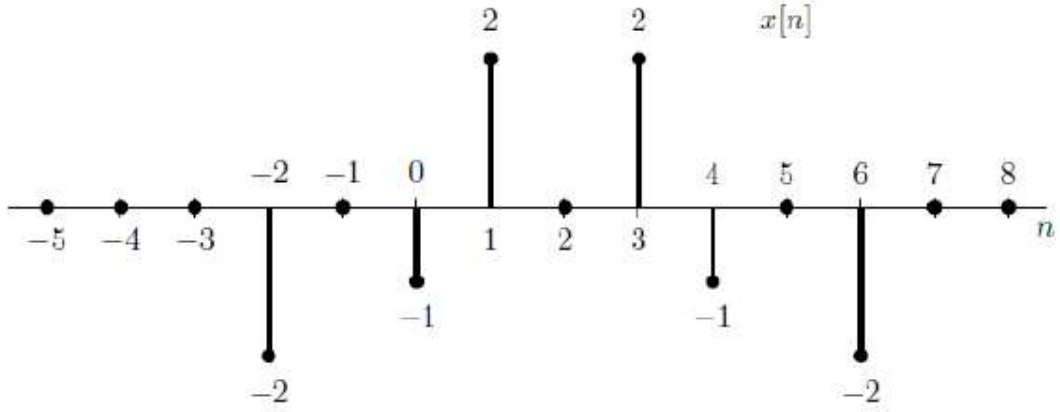






Problem 9：

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



(a) Find $X(1) = X(e^{j0})$.

(b) Find α such that $e^{j\alpha\omega}X(e^{j\omega})$ is real.

(c) Evaluate $\int_{-\pi}^{\pi} X(e^{j\omega})d\omega$.

(d) Find $X(e^{j\pi})$.

(e) Determine and sketch the signal whose Fourier transform is $\Re e\{X(e^{j\omega})\}$.

(f) Evaluate the following integrals:

$$\int_{-\pi}^{\pi} |X(e^{j\omega})|^2 d\omega$$