

## Practice for Quiz 4

1. A signal  $x(t)$  is periodic with period  $T = 8$ , so it can be represented as

$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{j(2\pi/8)kt}.$$

It is known that the FS coefficients for this representation of  $x(t)$  are given by

$$a_k = \frac{1}{8} \int_{-4}^0 (4+t) e^{-j(2\pi/8)kt} dt.$$

- (a) Determine an expression for  $x(t)$  that is valid over one period.  
 (b) Draw a plot of  $x(t)$  for  $-8 \leq t \leq 8$ . Label carefully.  
 (c) Determine the DC value of  $x(t)$ .
2.  $x[n]$  is a real, even, and periodic signal. Its Fourier series coefficients for  $N = 8$  are denoted by  $a_k$ .

(a) Let  $a_0 = 1$ ,  $a_1 = 1/2$ , and  $a_k = 0$  for  $1 < |k| < 7$ . Sketch the signal and write it as a sum of cosines

$$x[n] = \sum_{k=0}^{\infty} c_k \cos(2\pi kn/N + \phi_k).$$

(i.e., determine  $c_k$  and  $\phi_k$ .)

(b) Now, assume  $a_{4i} = 1$  for  $i \in \mathbb{Z}$ , and that all other coefficients are zero. What is the fundamental period of  $x[n]$ ?

(c) Assume we know that  $x[n]$  has fundamental period 8. Is it possible that  $a_1 = 0$ ? Explain.