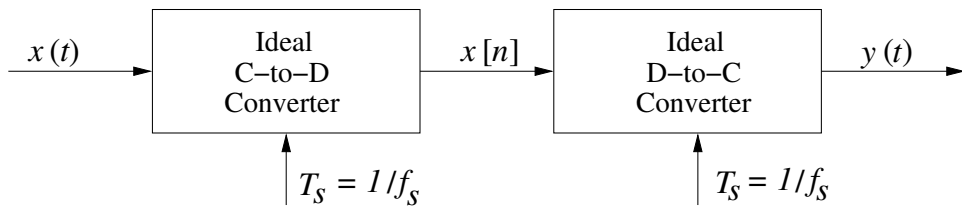


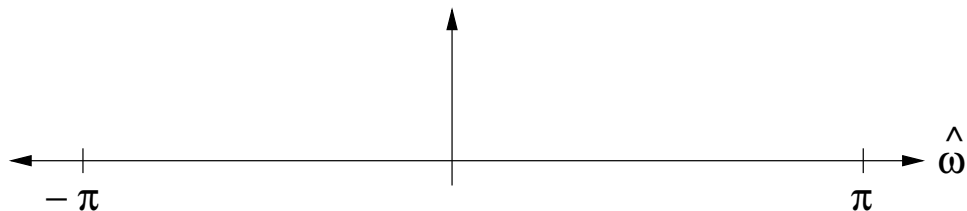
**PROBLEM:**

Shown in the figure above is an ideal C-to-D converter that samples  $x(t)$  with a sampling period  $T_s$  to produce the discrete-time signal  $x[n]$ . The ideal D-to-C converter then forms a continuous-time signal  $y(t)$  from the samples  $x[n]$ .

Let  $x(t) = 9 \cos(2\pi(7000)t) + 4 \sin(2\pi(4000)t)$ .

- (a) What is the minimum sampling rate such that  $y(t) = x(t)$ ?

- (b) Sketch the digital spectrum of  $x[n]$  when  $f_s = 18000$  samples/sec. Carefully label the amplitudes and frequencies in your sketch.



- (c) If we under-sample  $x(t)$ , aliases of the spectral components can appear in the baseband of the digital spectrum. What is the maximum sampling rate  $f_{s \max}$  such that the spectrum of  $x[n]$  will have a non-zero DC component?

Determine the amplitude value for the DC component of  $x[n]$  at this sampling rate.