Problem 4.21 in *Oppenheim/Schafer/Buck*
Can you sample slower than the Nyquist theorem would imply? Think about that before you answer!

Problem 4.24 in *Oppenheim/Schafer/Buck*

**Problem ECE535-3** (Old exam problem)
A continuous-time signal $x_c(t)$ is sampled and reconstructed using the ideal $C/D$ and $D/C$ converters in the system shown below. The sample period is $T = \frac{1}{600}$ seconds and the input signal is known to be a cosine: $x_c(t) = \cos(800\pi t)$.

![Sampling/Reconstruction System](image)

Determine and sketch the reconstructed signal, $y_c(t)$. Be sure to label your sketch.

**Problem ECE535-4** (Old exam problem)
Consider the continuous-time signal $x_c(t)$ with the Fourier transform $X_c(j\Omega)$ shown in Figure 1. The continuous-time signal $x_c(t)$ is processed by the system shown in Figure 2. The frequency response of the DT filter, $H(e^{j\omega})$, for this system is shown in Figure 3.

(a) What is the maximum value of $T$ that will avoid aliasing in the $C/D$ converter? In other words, find $T_{\text{max}}$ such that if $T < T_{\text{max}}$, then $x_c(t)$ can be recovered from $x[n]$. Justify your answer.

(b) Assuming that $T < T_{\text{max}}$ (where $T_{\text{max}}$ is the value found in part a), the system in Figure 2 is equivalent to the continuous-time system shown in Figure 4. Sketch the frequency response $H_{\text{eff}}(j\Omega)$ of the equivalent CT system.

(c) For this part assume that $T = \frac{1}{150}$. Sketch the Fourier transforms of $x[n]$, $y[n]$, and $y_c(t)$. In other words, sketch $X(e^{j\omega})$, $Y(e^{j\omega})$, and $Y_c(j\Omega)$. Be sure to label the frequency and amplitude of all important features. You only need to show the discrete-time spectra for $|\omega| \leq \pi$. 
Figure 1: Fourier transform of the CT signal $x_c(t)$.

Figure 2: Setup for DT processing of CT signals

Figure 3: DT filter frequency response

Figure 4: Equivalent CT system