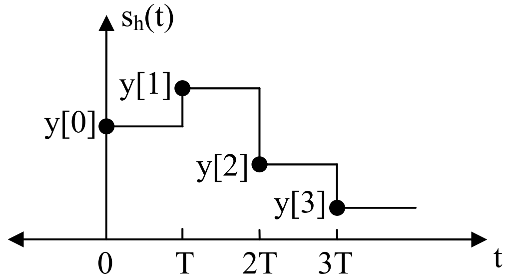
Due Tuesday, 6 July 2004 at 4:00 PM

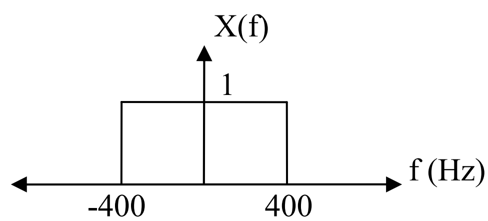
ECE 438 Assignment No. 5 Summer 2004

1. A *zero-order hold* system converts the discrete-time signal y[n] into the continuous-time signal $s_h(t)$ by holding the output during the time interval $kT \le t < (k+1)T$ to the value y[k], for any integer k. This process is illustrated below.



   a. Find an expression for $S_h(f)$ = CTFT{$s_h(t)$} in terms of $Y(e^{j\omega})$ = DTFT{y[n]}. Note this is asking for $S_h(f)$, and not $|S_h(f)|$. Show your work. Hint: A similar derivation was performed in class.

   b. Suppose the sequence y[n] is obtained by sampling the signal x(t) at a sampling frequency f_s = 1 kHz (1000 samples per second). Let $T=1/f_s$. If x(t) has the CTFT given below, sketch $Y(e^{j\omega})$ and $|S_h(f)|$. Label the axes of your plots.



   c. Determine the frequency response H(f) of an *ideal* filter that reconstructs the signal x(t) defined above. The filter should satisfy $|S_h(f)H(f)| = |X(f)|$. Specify the values of H(f) for all f, and sketch |H(f)|.

2. Let x[n] be a signal with DTFT $X(e^{j\omega})$ given below, and define an ideal low-pass filter with frequency response $H(e^{j\omega})$ also given below. Sketch the DTFT of each of the signals $y_k[n]$. Label the axes of your plots.