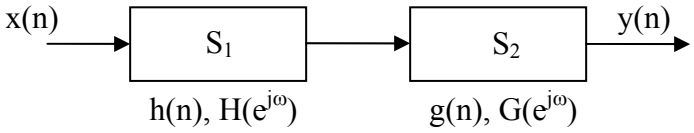
Due Friday, 2 July 2004 at 4:00 PM

ECE 438 Assignment No. 4 Summer 2004

1. Using the definition of the discrete-time Fourier transform, show the time-shifting property is true:

$$x(n-n_0) \overset{DTFT}{\Longleftrightarrow} X(e^{j\omega})e^{-j\omega n_o}$$

2. Consider the following cascade of the LTI systems S_1 and S_2, with impulse responses h(n) and g(n) respectively:



The impulse response of S_1 is $h(n) = r^n u(n)$, where r is some real constant such that $0 < r < 1$. Your objective is to design an inverse system S_2 such that $y(n) = x(n)$ in the above cascaded system.

   a. Determine an expression for the frequency response $H(e^{j\omega})$ from the impulse response h(n).

   b. Determine the frequency response $G(e^{j\omega})$ that meets the design objective. Sketch $|G(e^{j\omega})|$ for $-\pi \le \omega \le \pi$.

   c. Find the impulse response g(n), and the difference equation describing the system S_2.

3. Consider the system described by $y(n) = (-1)^n x(n)$.

   a. Find $Y(e^{j\omega})$ in terms of $X(e^{j\omega})$.

   b. For the specific $X(e^{j\omega})$ graphed below, sketch $Y(e^{j\omega})$.