Homework #1
Due Th. 1/31

1. (OS 2.23 a,b,c) + additional systems
   For each of the following systems, determine whether the system is (1) stable, (2) causal, (3) linear, and (4) time-invariant.

   (a) $T(x[n]) = (\cos \pi n)x[n]$
   (b) $T(x[n]) = x[n^2]$
   (c) $T(x[n]) = x[n] \sum_{k=0}^{\infty} \delta[n-k]$
   (d) $T(x[n]) = e^{x[n]}$
   (e) $T(x[n]) = ax[n] + b$

2. (OS 2.33)

3. (OS 2.47)

4. (OS 2.77)

5. For any $0 < N_1, N_2 < \infty$,

   (a) For $a \neq 1$, find a closed form expression for

   $$\sum_{n=N_1}^{N_2} a^n$$

   (b) For $|a| < 1$, find a closed form expression for

   $$\sum_{n=N_1}^{\infty} a^n.$$

6. Given the two sequences

   $$x[n] = \left(-\frac{1}{2}\right)^n u[n-4] \qquad\qquad h[n] = 4^n u[2-n]$$

   (a) Use the convolution sum formula to find $y[n] = h[n] * x[n]$.
   (b) Calculate the correlation beteween $x[n]$ and $h[n]$ where the correlation is defined as

   $$c_{xh}[l] = \sum_{k=-\infty}^{\infty} x[k]h[l+k].$$