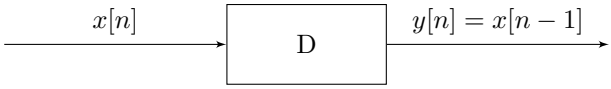
ELEN3013: SIGNALS AND SYSTEMS IIB - Tutorial 1

1. Determine the following signals are periodic. It its periodic determine the fundamental period.
   (a) $x[n] = e^{j[(\frac{n}{4}-\pi)]}$.
   (b) $x[n] = cos(\frac{n}{2})cos(\frac{\pi n}{4})$.
   (c) $x[n] = cos(\frac{n\pi}{4}) + sin(\frac{n\pi}{8}) - 2cos(\frac{n\pi}{2})$.
   (d) $x[n] = \cos(\frac{n^2\pi}{8})$

2. Consider the unit delay



   Determine whether the system is

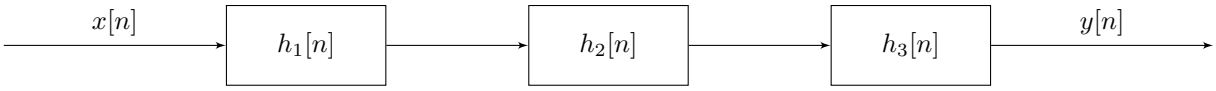
   a memoryless
   b causal
   c linear
   d time-invariant
   e BIBO stable

3. Show that if $x[n]$ is odd then $\sum_{k=-\infty}^{\infty} x[k] = 0$

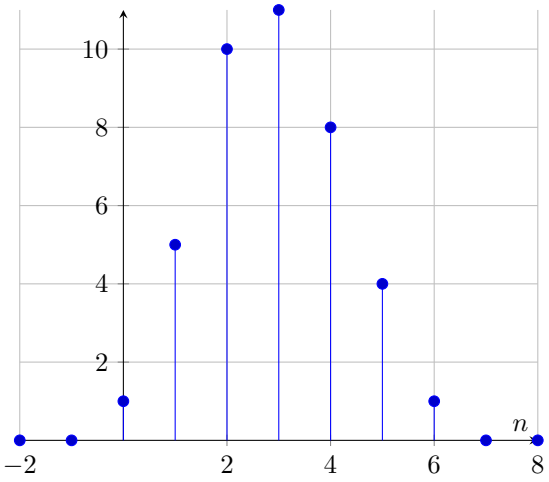
4. If $x[n]$ is periodic with fundamental period N_0 show that $y[n]$ the output of a system with impulse response $h[n]$ will be periodic with fundamental period N_0.

5. Let $y[n] = x[n] * h[n]$ then show that $x[n - n_1] * h[n - n_2] = y[n - n_1 - n_2]$

6. Consider the cascade interconnection of 3 LTI systems



   The impulse response $h_2[n] = u[n] - u[n-2]$ and the overall system response is



(a) Find the impulse response $h_1[n]$.

(b) Find the response of the system to the input $x[n] = \delta[n] - \delta[n-1]$

7. Consider the system defined by the difference equation

$$y[n] - \frac{1}{2}y[n-1] = x[n] + 2x[n-1] \tag{1}$$

Calculate the system's step response.