Tutorial 2 on Week 3

1. Determine the fundamental period of the continuous-time signal $x(t)$:

$$x(t) = 2\cos(10t + 1) - \sin(4t - 1)$$

2. Consider a discrete-time system S with input $x[n]$ and output $y[n]$. This system is obtained through a series interconnection of a system S_1 followed by another system S_2. The input and output relationships for S_1 and S_2 are:

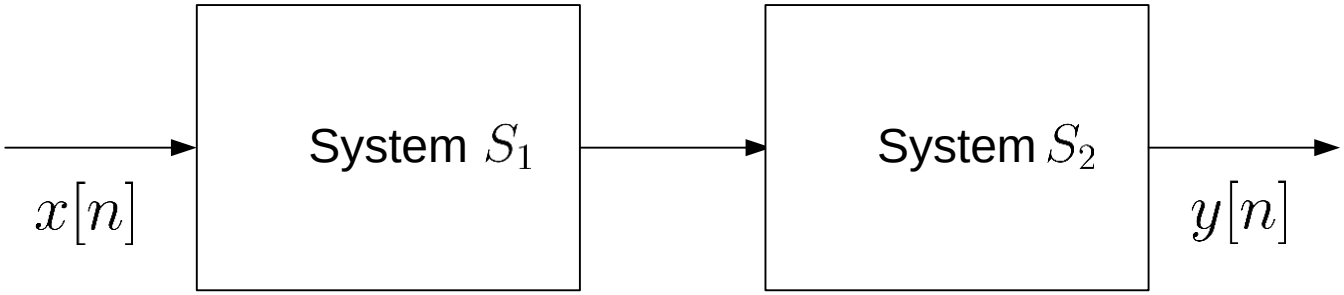
$$S_1 : y_1[n] = 2x_1[n] + 4x_1[n-1]$$

$$S_2 : y_2[n] = x_2[n-2] + \frac{1}{2}x_2[n-3]$$

where $x_1[n]$ and $x_2[n]$ denote inputs and $y_1[n]$ and $y_2[n]$ denote outputs.

(a) Determine the input-output relationship for system S, i.e., find the equation that relates $x[n]$ and $y[n]$.

(b) Does the input-output relationship of system S change if we first pass $x[n]$ through S_2 and then S_1?



3. Determine whether the following discrete-time system, with input signal $x[n]$ and output signal $y[n]$ is memoryless, invertible, stable, causal, linear, and/or time-invariant:

$$y[n] = ax[n+1] + b, \quad 0 < |a| < \infty,\ 0 < |b| < \infty$$

4. Determine whether the following continuous-time system, with input signal $x(t)$ and output signal $y(t)$ is memoryless, invertible, stable, causal, linear, and/or time-invariant:

$$y(t) = \cos\left[x(t)\right]$$

5. Consider the following discrete-time system, with input signal $x[n]$ and output signal $y[n]$:

$$y[n] = x[n-1] - y[n-1]$$

where $y[n] = 0$ for $n < 0$.

(a) Determine $y[n]$ when $x[n] = \delta[n]$.
(b) Determine $y[n]$ when $x[n] = u[n]$.

6. Show that $\delta(2t) = \frac{1}{2}\delta(t)$.