430.306: Signal and Systems

Electrical and Computer Engineering, Seoul National Univ.
Spring Semester, 2018
Quiz #1 (March 27, 30 minutes)

Problem 1)[20pt] Answer the following questions.

(a)[10pt] Compute the convolution $y[n] = x[n] * h[n]$, where

$$x[n] = \left(\frac{1}{3}\right)^{-n} u[-n-1] \quad \text{and} \quad h[n] = u[n-1].$$

(b)[10pt] Compute the convolution $y(t) = x(t) * h(t)$, where

$$x(t) = \begin{cases} t+1, & 0 \le t \le 1 \\ 2-t, & 1 < t \le 2 \\ 0, & \text{elsewhere} \end{cases} \quad \text{and} \quad h(t) = \delta(t+2) + 2\delta(t+1).$$

Problem 2)[20pt] Consider the causal LTI system described by the difference equation

$$y[n] - \frac{1}{5}y[n-1] = x[n].$$

(a)[10pt] Find out the impulse response $h[n]$ for this system.

(b)[10pt] Determine whether this system satisfies BIBO stability or not. You should justify your answer.

Problem 3)[20pt] Check whether each of the following statements is true or false. In order to get the full credit, you should justify your answer.

(a)[5pt] The system whose input-output relationship is given by $y(t) = \cos[x(t)]$ is invertible.

(b)[5pt] The system whose input-output relationship is given by $y[n] = \mathrm{Im}(x[n])$ is linear ($\mathrm{Im}(x[n])$ denotes the imaginary part of $x[n]$).

(c)[10pt] $y(t) = 4e^{j3t}$ could be the output signal for some LTI system corresponding to the input signal $x(t) = e^{j5t}$.