

Signals and Systems HW2

Deadline: 2019/3/15 before 18:30

(You should submit hand-writing paper to BL B1 EE student office.)

1. Let $\delta_{\Delta}(t)$ denotes the rectangular pulse of height $\frac{1}{\Delta}$ for $0 < t \leq \Delta$. Show that

$$\frac{d}{dt} \delta_{\Delta}(t) = \frac{1}{\Delta} [\delta(t) - \delta(t - \Delta)]. \quad (20\%)$$

2. Consider a discrete-time, linear and time-invariant system that has impulse response $h[n] = (\frac{1}{5})^n u[n]$ and input $x[n]$. Answer the following questions and justify your answer.

- (a) (20%) Evaluate and sketch the response $y_1[n]$ of the system if $x[n] = x_1[n] = \delta[n - d]$, for integer $d = 3$.
- (b) (20%) Evaluate and sketch the response $y_2[n]$ of the system if $x[n] = x_2[n] = u[n - e]$, for integer $e = 5$.
- (c) (20%) Identify the relationship between $y_1[n]$ and $y_2[n]$.

3. The following are the impulse responses of discrete-time LTI systems. Determine whether each system is causal and/or stable. Justify your answers.

- (a) (5%) $h[n] = (0.99)^n u[n]$
- (b) (5%) $h[n] = (0.7)^n u[n + 3]$
- (c) (5%) $h[n] = (\frac{1}{3})^n u[-n]$
- (d) (5%) $h[n] = (4)^n u[4 - n]$