

# Assignment 2

## EE3900 - Linear Systems and Signal Processing

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## Discrete-time Signal Processing

### Oppenheim and Schafer

**Problem 2.21(a)** Consider an arbitrary linear system with input  $x[n]$  and output  $y[n]$ . Show that if  $x[n] = 0$  for all  $n$ , then  $y[n]$  must also be zero for all  $n$ .

**Solution:** For an arbitrary linear system,

$$y[n] = T \{x[n]\}, \quad (1)$$

Let  $x[n] = 0$  for all  $n$ .

$$y[n] = T \{x[n]\} \quad (2)$$

For some arbitrary  $x_1[n]$ , we have

$$y_1[n] = T \{x_1[n]\} \quad (3)$$

Using the linearity of the system:

$$T \{x[n] + x_1[n]\} = T \{x[n]\} + T \{x_1[n]\} \quad (4)$$

$$= y[n] + y_1[n] \quad (5)$$

Since  $x_1[n]$  is zero for all  $n$ ,

$$T \{x[n] + x_1[n]\} = T \{x[n]\} = y_1[n] \quad (6)$$

Hence,  $y[n]$  must also be zero for all  $n$ .