

## Notes for Signals and Systems

### 1.2 Elementary Operations on Signals

Several basic operations by which new signals are formed from given signals are familiar from the algebra and calculus of functions.

- *Amplitude Scale*:  $y(t) = a x(t)$ , where  $a$  is a real (or possibly complex) constant
- *Amplitude Shift*:  $y(t) = x(t) + b$ , where  $b$  is a real (or possibly complex) constant
- *Addition*:  $y(t) = x(t) + z(t)$
- *Multiplication*:  $y(t) = x(t) z(t)$

With a change in viewpoint, these operations can be viewed as simple examples of *systems*, a topic discussed at length in the sequel. In particular, if  $a$  and  $b$  are assumed real, and  $z(t)$  is assumed to be a fixed, real signal, then each operation describes a system with input signal  $x(t)$  and output signal  $y(t)$ . This viewpoint often is not particularly useful for such simple situations, however.

The description of these operations for the case of discrete-time signals is completely analogous.