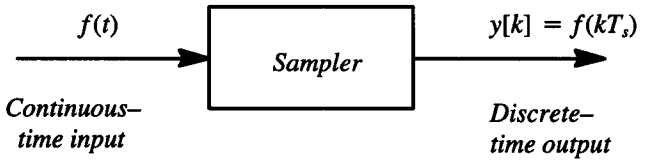
SYSTEM CLASSIFICATION EXERCISES

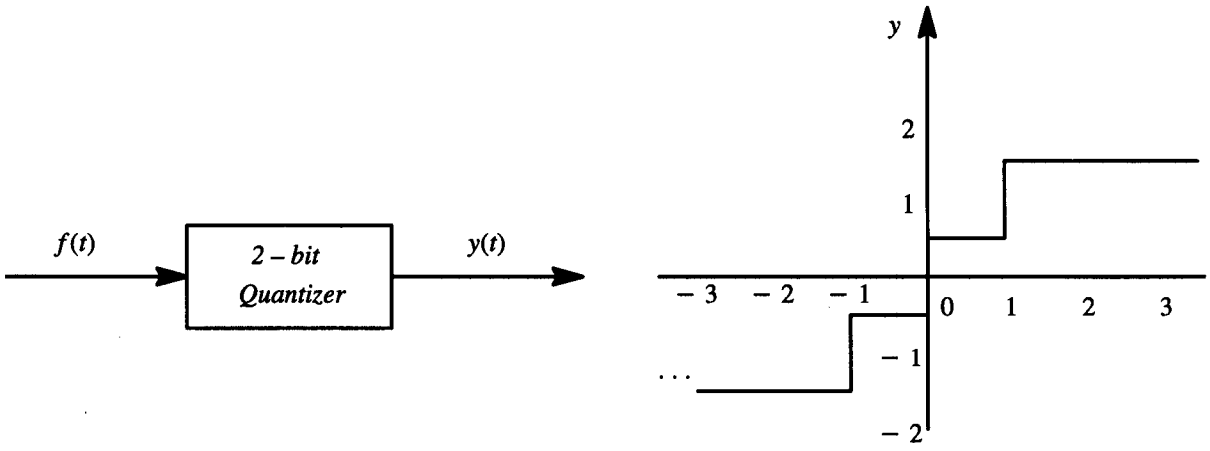
(a) Sampling system: The output of the sampler is the value of the input at discrete instants in time. The spacing between samples is T_s seconds.



(i) The sampling system is: linear
nonlinear
can't tell — not enough information.

(ii) The sampling system is: time–invariant
time–varying
can't tell — not enough information.

(b) Quantization system: The output at any time t is equal to the input amplitude *rounded* to one of four levels, as shown on the plot of input f versus output y.

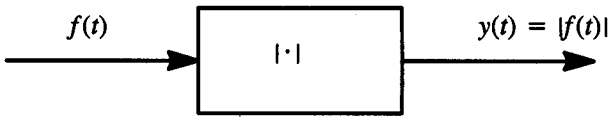


Any input in the range 0 to 1 is rounded to 0.5, any input greater than 1 is rounded to 1.5, etc.

(i) The quantizing system is: linear
nonlinear
can't tell — not enough information.

(ii) The quantizing system is: time–invariant
time–varying
can't tell — not enough information.

(c) Rectifier system: Output equals absolute value of the input at all time.



(i) The rectifier system is: linear
nonlinear
can't tell — not enough information.

(ii) The rectifier system is: time–invariant
time–varying
can't tell — not enough information.

1.31. In this problem, we illustrate one of the most important consequences of the properties of linearity and time invariance. Specifically, once we know the response of a linear system or a linear time-invariant (LTI) system to a single input or the responses to several inputs, we can directly compute the responses to many other input signals. Much of the remainder of this book deals with a thorough exploitation of this fact in order to develop results and techniques for analyzing and synthesizing LTI systems.

(a) Consider an LTI system whose response to the signal $x_1(t)$ in Figure P1.31(a) is the signal $y_1(t)$ illustrated in Figure P1.31(b). Determine and sketch carefully the response of the system to the input $x_2(t)$ depicted in Figure P1.31(c).

(b) Determine and sketch the response of the system considered in part (a) to the input $x_3(t)$ shown in Figure P1.31(d).

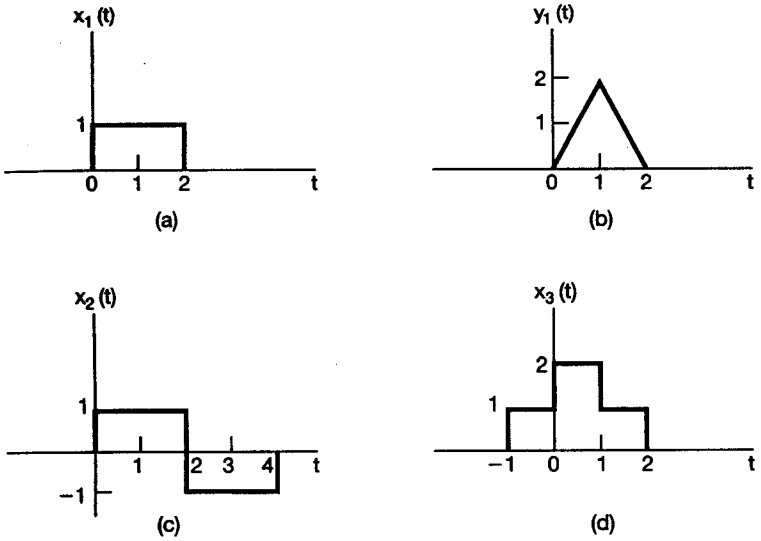


Figure P1.31