Assignment no 01: Chapter 1

Note: You can check the exercises after the book Chapter.
In our assignment, we are using the first edition of "Signals and Systems: A MATLAB Integrated Approach" By Oktay Alkin.

Examples

Example 1.2: Two signals $x_1(t)$ and $x_2(t)$ are shown in Fig. 1.11. **Sketch** the signals

a. $g_1(t) = x_1(t) + x_2(t)$

b. $g_2(t) = x_1(t)\, x_2(t)$

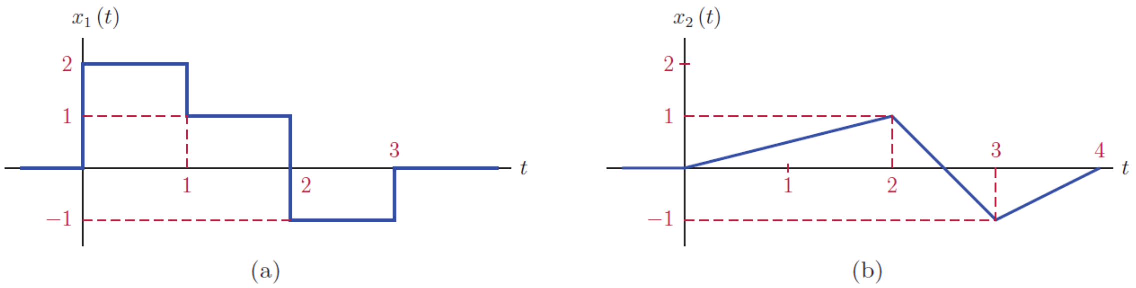


Figure 1.11 – Signals $x_1(t)$ and $x_2(t)$ for Example 1.2.

Example 1.3: **Consider** the signal $x(t)$ shown in Fig. 1.16. **Sketch** the following signals:

a. $g(t) = x(2t - 5)$

b. $h(t) = x(-4t + 2)$

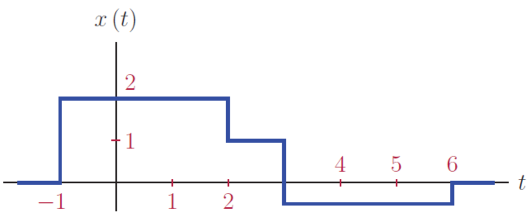


Figure 1.16 – The signal $x(t)$ for Example 1.3.

Example 1.6: **Discuss** the periodicity of the signals:

a. $x(t) = \sin(2\pi\, 1.5t) + \sin(2\pi\, 2.5t)$

b. $y(t) = \sin(2\pi\, 1.5t) + \sin(2\pi\, 2.75t)$

Example 1.16: **Check** the periodicity of the following discrete-time signals:

a. $x[n] = \cos(0.2n)$

b. $x[n] = \cos(0.2\pi n + \pi/5)$

c. $x[n] = \cos(0.3\pi n - \pi/10)$

Problems

1.1. Sketch and label each of the signals defined below:

a. $$x_a(t) = \begin{cases} 0\,, & t < 0 \text{ or } t > 4 \\ 2\,, & 0 < t < 1 \\ 1\,, & 1 < t < 2 \\ t-1\,, & 2 < t < 3 \\ 2\,, & 3 < t < 4 \end{cases}$$

1.2. Consider the signals shown in Fig. P.1.2. For each signal **write** the analytical description in segmented form similar to the descriptions of the signals in Problem 1.1.

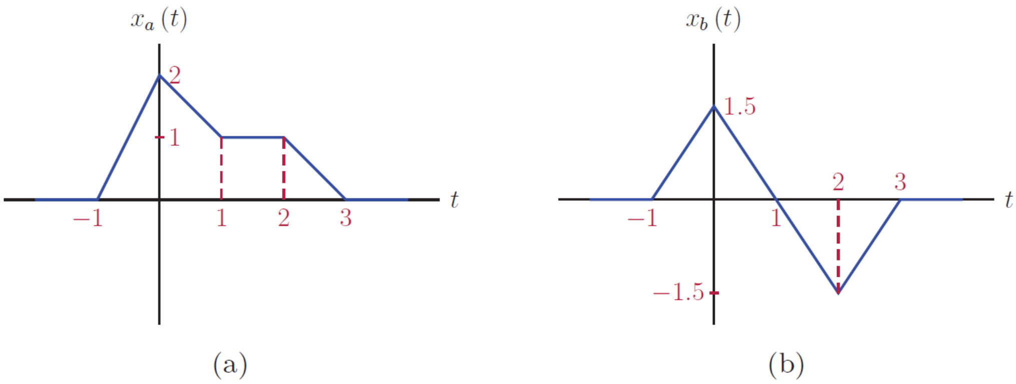


Figure P. 1.2

1.3. Using the two signals $x_a(t)$ and $x_b(t)$ given in Fig. P.1.2, **compute** and **sketch** the signals specified below:

c. $g_3(t) = 2x_a(t) - x_b(t) + 3$

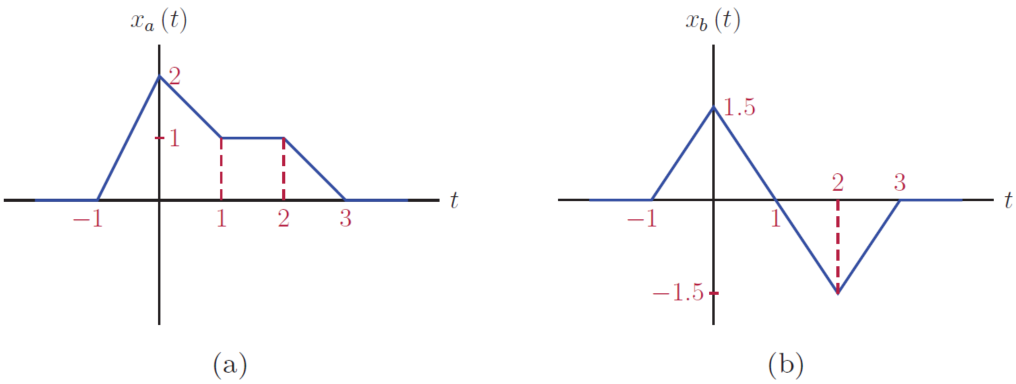


Figure P. 1.2

1.4. For the signal $x(t)$ shown in Fig. P.1.4, **compute** the following:

g. $g_7(t) = x\left(1 - \frac{t}{3}\right)$

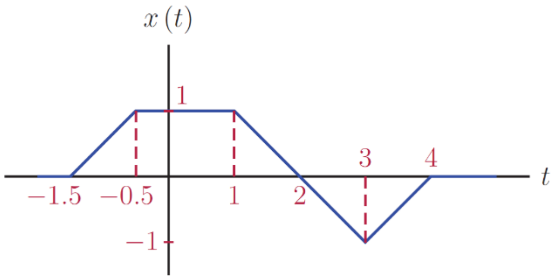


Figure P. 1.4

1.8. Sketch each of the following functions.

a. $\delta(t) + \delta(t-1) + \delta(t-2)$

1.9. Sketch each of the following functions in the time interval $-1 \le t \le 5$.

Afterwards **use** the waveform explorer program "`wav demo1.m`" to check your results.

a. $u(t) + u(t-1) - 3u(t-2) + u(t-3)$

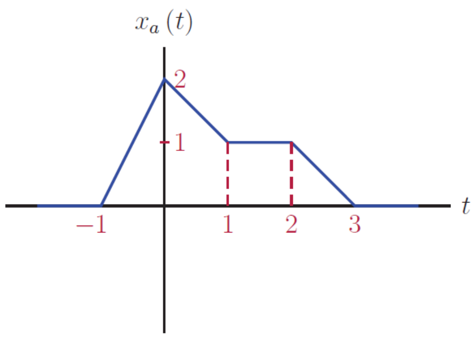
e. $\Lambda(t) + 2\Lambda(t-1) + 1.5\Lambda(t-3) - \Lambda(t-4)$

1.17. Using the definition of periodicity, **determine** if each signal below is periodic or not. If the signal is periodic, **determine** the fundamental period and the fundamental frequency.

b. $x(t) = 2\sin\left(\sqrt{20}t\right)$

g. $x(t) = e^{j(2t+\pi/10)}$

1.22. Determine the normalized energy of each of the signals shown in Fig. P.1.2.



(a)

Figure P. 1.2

1.23. Determine the normalized average power of each of the periodic signals shown in Fig.P.1.23.

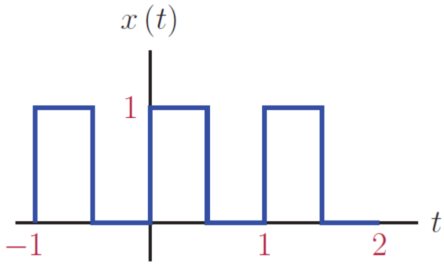


Figure P. 1.23

1.25. Identify which of the signals in Fig. P.1.25 are even, which ones are odd, and which signals are neither even nor odd.

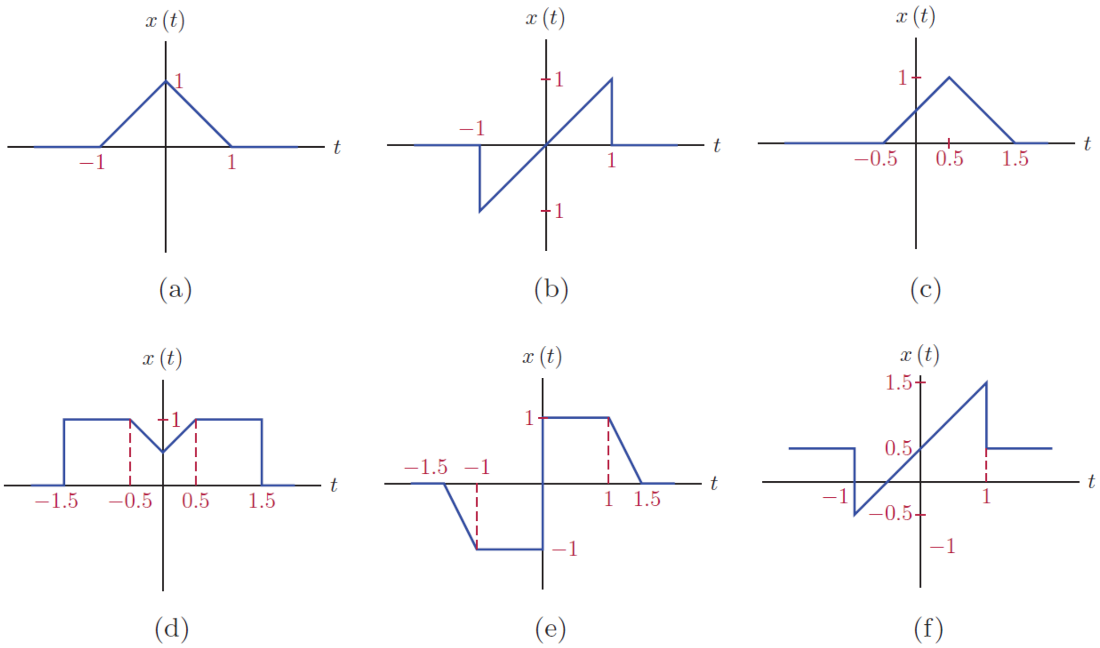


Figure P. 1.25

1.33. For the signal $x[n]$ shown in Fig. P.1.33, **sketch** the following signals.

a. $g[n] = x[n-3]$

e. $g[n] = \begin{cases} x[n/2]\ , & \text{if } n/2 \text{ is integer} \\ 0\ , & \text{otherwise} \end{cases}$

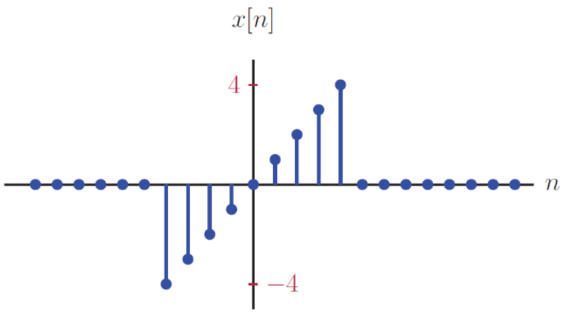


Figure P. 1.33

MATLAB Problems

1.47. Consider the discrete-time signal $x[n]$ used in Problem 1.33 and graphed in Fig.P.1.33.

a. Express this signal through an anonymous MATLAB function that utilizes the function `ss_ramp(..)`, and graph the result for index range $n = -10, \ldots, 10$.

b. Express each of the signals in parts (a) through (h) of Problem 1.33 in MATLAB, and graph the results. **Use** functions `ss_step(..)` and `ss_ramp(..)` as needed.

- **a.** $g[n] = x[n-3]$
- **b.** $g[n] = x[2n-3]$
- **c.** $g[n] = x[-n]$
- **d.** $g[n] = x[2-n]$
- **e.** $g[n] = \begin{cases} x[n/2] \,, & \text{if } n/2 \text{ is integer} \\ 0 \,, & \text{otherwise} \end{cases}$
- **f.** $g[n] = x[n]\,\delta[n]$
- **g.** $g[n] = x[n]\,\delta[n-3]$
- **h.** $g[n] = x[n]\;\{u[n+2] - u[n-2]\}$

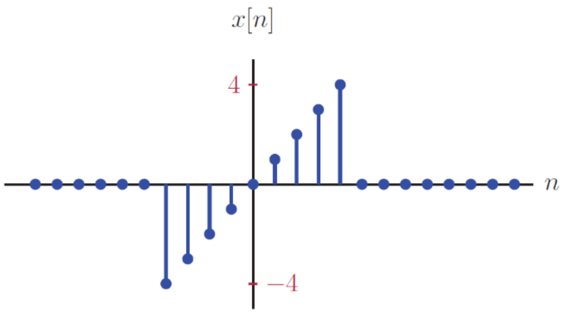


Figure P. 1.33