Test 1

Question 1

(a) Express the signal in Fig 1-41 below, as an addition/subtraction of unit step functions plus shifts.

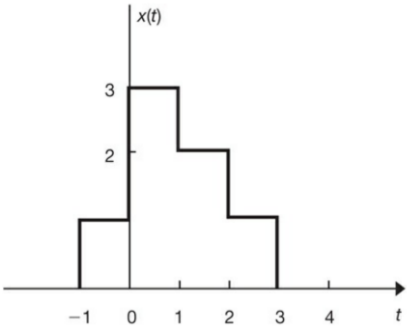


Fig. 1-13

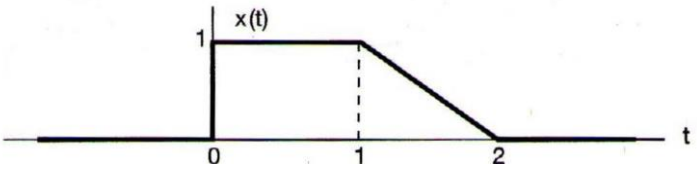


Fig. 1-41

(b) For the signal x(t) shown in Fig 1-13, transform it into x(-t+1)

Question 2

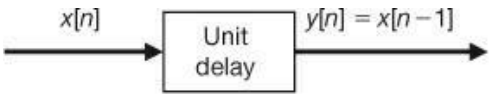
The discrete-time system shown in Fig. 1-36 is known as the unit delay element. Determine whether the system is: (Answer yes/no for each part)

(a) memoryless,

(b) causal,

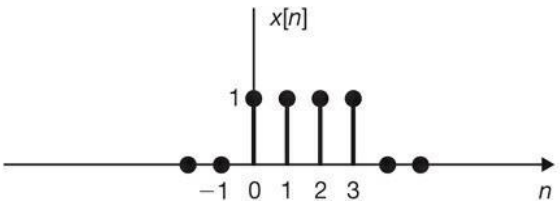
(c) time-invariant

(d) stable.



Question 3

2.30. Evaluate y[n] = x[n] * h[n], where x[n] and h[n] are shown in Fig. 2-23, by a graphical method (i.e. the quick method).



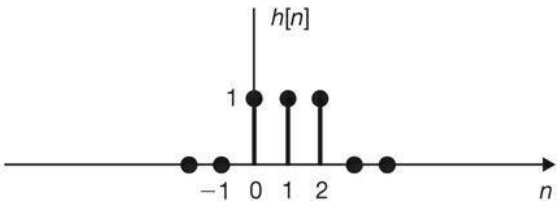


Fig. 2-23

Question 4

(a) For the system shown in Fig, 2-31, find

a. The overall impulse response h(t) of the system

b. Is the system stable?

$$h_1(t) = e^{-2t}u(t) \qquad \text{and} \qquad h_2(t) = 2e^{-t}u(t)$$

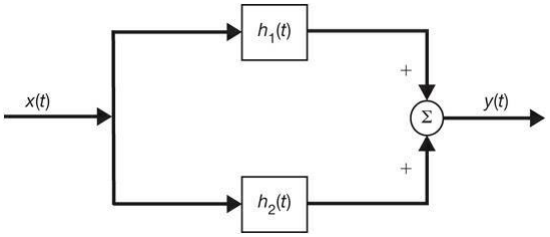


Fig 2-31

(b) Consider the system with impulse response as below. Find the input-output relationship.

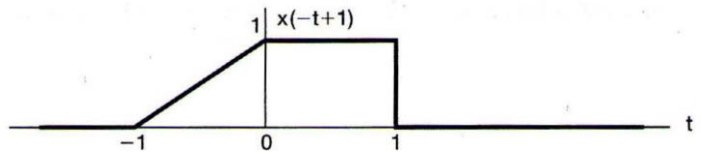
$$h[n] = \begin{cases} 1 & n = 0, 1 \\ 0 & \text{otherwise} \end{cases}$$

Test 1 - Solution

Question 1

(a) $x(t) = u(t+1) + 2u(t) - u(t-1) - u(t-2) - u(t-3)$

(b)



Question 2

(a) NO, since the output n depends on the input [n-1]

(b) YES, since the output does not depend on future value [n+1]

(c) YES, because

Let $y_1[n]$ be the response to $x_1[n] = x[n - n_0]$. Then

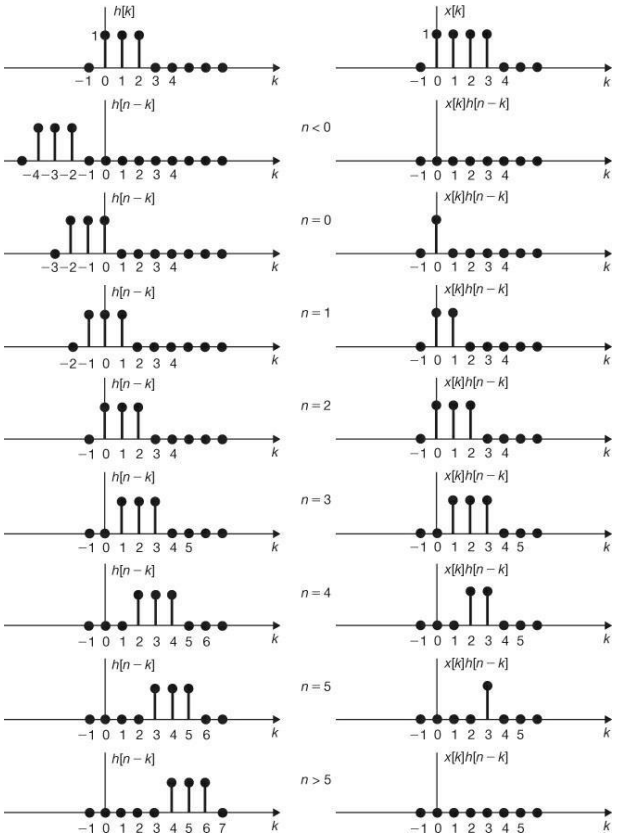
$$y_1[n] = \mathbf{T}\{x_1[n]\} = x_1[n-1] = x[n-1-n_0]$$

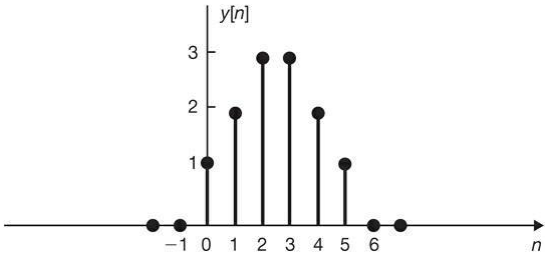
$$y[n-n_0] = x[n-n_0-1] = x[n-1-n_0] = y_1[n]$$

(d) YES, because

$$|y[n]| = |x[n-1]| \le k \qquad \text{if } |x[n]| \le k \text{ for all } n$$

Question 3





Question 4

Part a

2.53. (*a*) $h(t) = (e^{-2t} + 2e^{-t})\,u(t)$

(*b*) Yes

Part b

2.63. $y[n] = x[n] + x[n-1]$