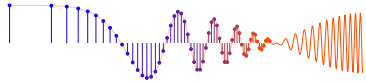

EXERCISE 5.1: Determine the output of a *centralized averager*

$$y[n] = \tfrac{1}{3}(x[n+1] + x[n] + x[n-1])$$

for the input in Fig. 5-2. Is this filter causal or noncausal? What is the support of the output for this input? How would the plot of the output compare to Fig. 5-3?

McClellan, Schafer and Yoder, *Signal Processing First,* ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

$$y[0] = \frac{1}{3}\left(x[1] + x[0] + x[-1]\right) = \frac{1}{3}(4+2+0) = 2$$

$$y[-1] = \frac{1}{3}\left(x[0] + x[-1] + x[-2]\right) = \frac{1}{3}(2+0+0) = 2/3$$

$$y[-2] = 0$$

$$y[1] = \frac{1}{3}\left(x[2] + x[1] + x[0]\right) = \frac{1}{3}(6+4+2) = 4$$

Make a table:

n	≤-2	-1	0	1	2	3	4	5	6	≥7
x[n]	0	0	2	4	6	4	2	0	0	0
y[n]	0	2/3	2	4	14/3	4	2	2/3	0	0

Since y[n] starts before x[n] ⇒ NOT causal

SUPPORT IS:

$-1 \le n \le 5$