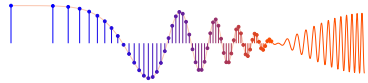


PROBLEM:

The *unit step* sequence, denoted by $u[n]$, is defined as

$$u[n] = \begin{cases} 0 & n < 0 \\ 1 & n \geq 0 \end{cases}$$

(a) Make a plot of $u[n]$ for $-5 \leq n \leq 10$. Describe the plot of $u[n]$ outside this range.

(b) We can use the unit step sequence as a convenient representation for sequences that are given by formulas over a range of values. For example, make a plot of the sequence

$$x[n] = (.5)^n(u[n] - u[n-5])$$

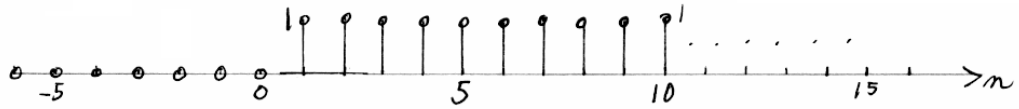
for $-5 \leq n \leq 10$. *Hint: First determine the values of the sequence* $(u[n] - u[n-5])$.

(c) Suppose that $x[n]$ in part (b) is the input to a 4-point running average system. Compute and plot $y[n]$, the output of the system for $-5 \leq n \leq 10$.

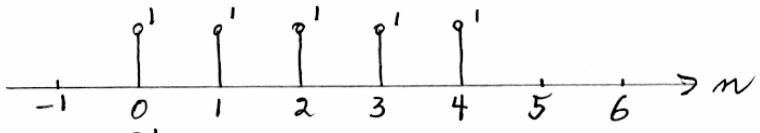
McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

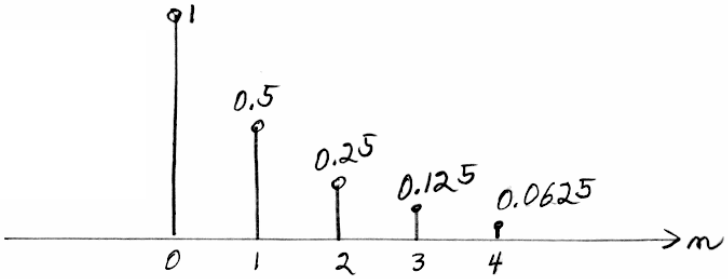
SOLUTION

(a)



(b) $u[n] - u[n-5]$





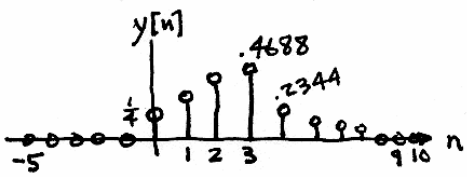
(c) For a four point running averager, the impulse response is

$$h[n] = \frac{1}{4}\left(\delta[n] + \delta[n-1] + \delta[n-2] + \delta[n-3]\right)$$

Using convolution:

$n =$	0	1	2	3	4	5	6	7	8	9	10
$h[n] =$	1/4	1/4	1/4	1/4							
$x[n] =$	1	1/2	1/4	1/8	1/16						
	1/4	1/8	1/16	1/32	1/64						
		1/4	1/8	1/16	1/32	1/64					
			1/4	1/8	1/16	1/32	1/64				
				1/4	1/8	1/16	1/32	1/64			
$y[n] =$	1/4	.375	.4375	.4688	.2344	.1094	.0469	.0156			

for $n<-5$, $u[n]=0$
for $n>10$, $u[n]=1$



$y[n]=0$ for $n<0$ and for $n>7$

NOTE: length{y[n]} = 8
= len{x} + len{h} - 1
= 5 + 4 - 1 = 8