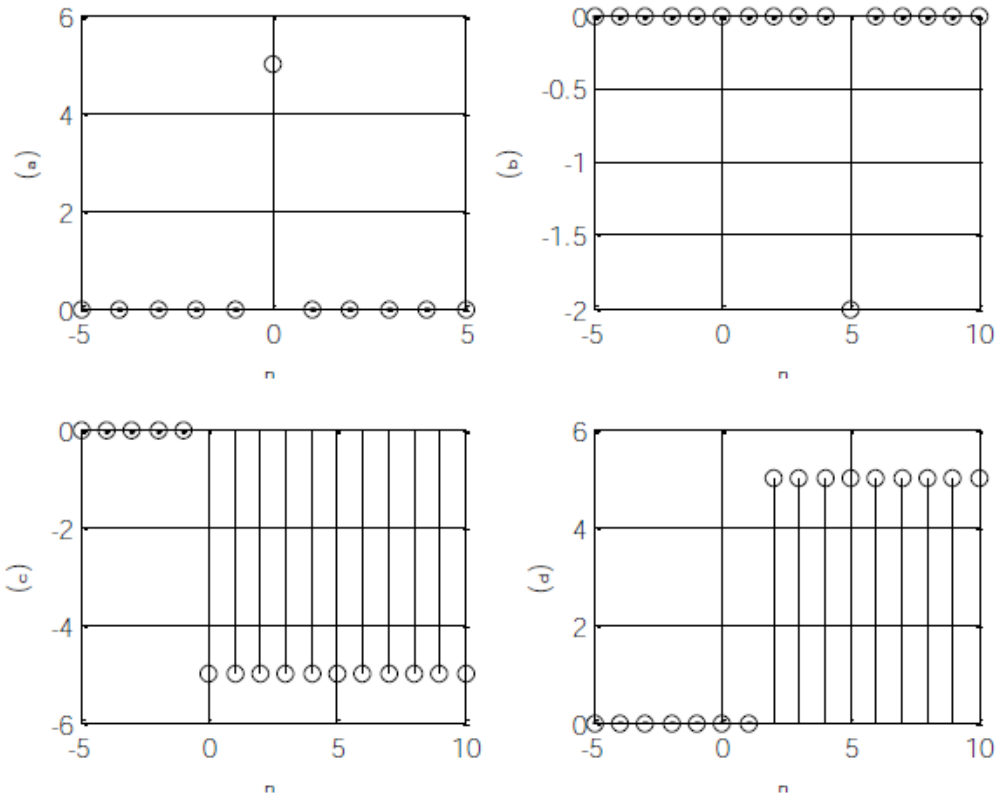
Fayoum University
Faculty of Computers & Information
Second Year
Digital Signal Processing
Year 2020 / 2021

Sheet 1

1-



2-

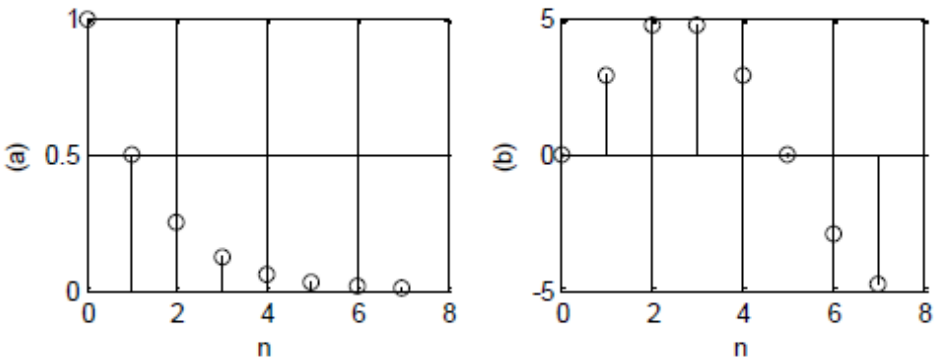
3.2

a.

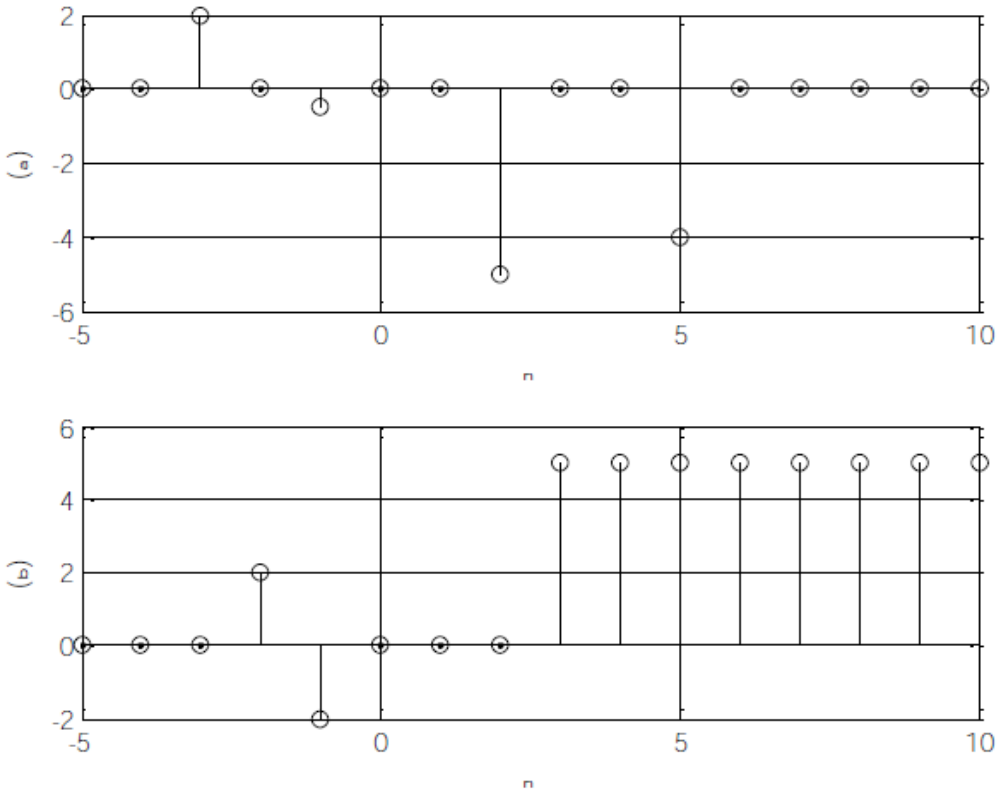
n	0	1	2	3	4	5	6	7
$x(n)$	1.000	0.5000	0.2500	0.1250	0.0625	0.0313	0.0156	0.0078

b.

n	0	1	2	3	4	5	6	7
$x(n)$	0.0000	2.9389	4.7553	4.7553	2.9389	0.0000	-2.9389	-4.7553



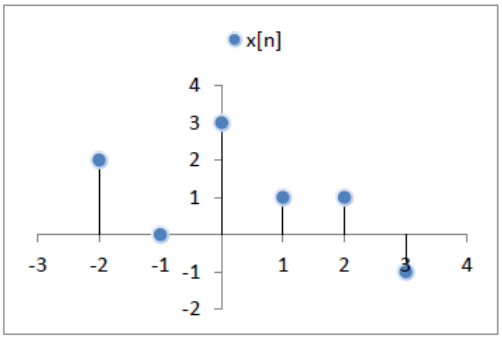
3-



4-

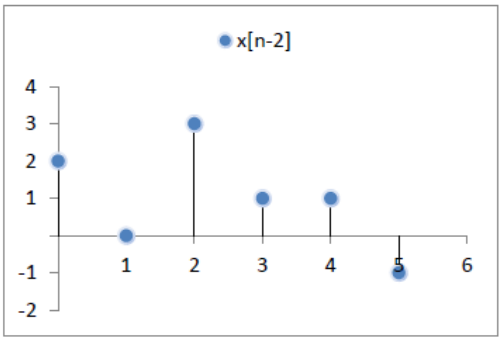
The arrow (brace) indicates the zeroth sample ($n = 0$).

$x[n] = [2 \quad 0 \quad \underset{\smile}{3} \quad 1 \quad 1 \quad -1]$



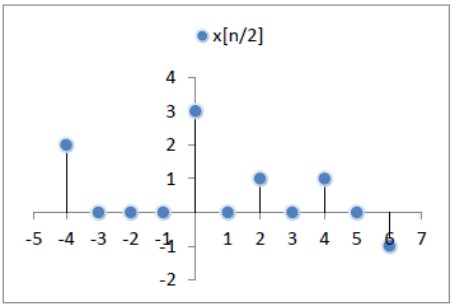
a) $x[n-2]$

$x[n+\beta]$ means shifting $x[n]$ by β samples to the left if $\beta > 0$, or to the right if $\beta < 0$.



b) $x[n/2]$

$x[\alpha n]$ means scaling the time axis by a factor of α so that the signal samples are brought closer together if $|\alpha| > 1$, and spaced further apart if $|\alpha| < 1$ (with the insertion of zeros in-between samples). The signal is mirrored relative to the y-axis if $\alpha < 0$.



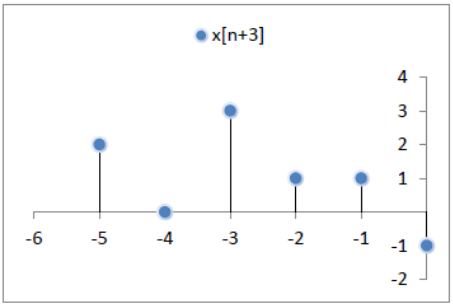
c) $[-2n+3]$

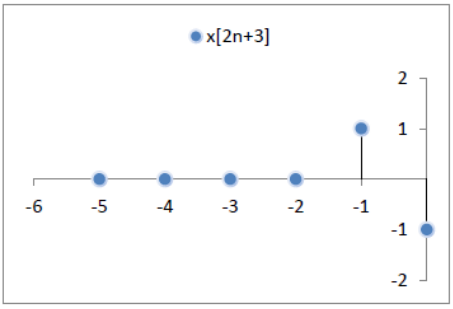
Obtaining $x[\alpha n+\beta]$ from $x[n]$ involves 3 consecutive steps:

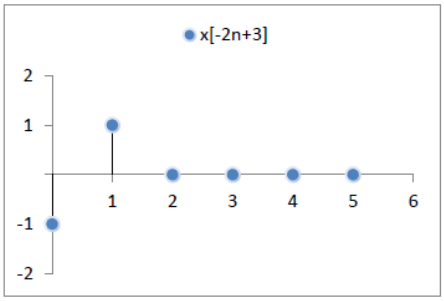
1- Shifting the signal by β samples to the left if $\beta > 0$, or to the right if $\beta < 0$

2- Scaling the time axis by a factor of α so that the signal samples are brought closer together if $|\alpha| > 1$, and spaced further apart if $|\alpha| < 1$ (with the insertion of zeros in-between samples)

3- Mirroring the signals samples relative to the y-axis if $\alpha < 0$.

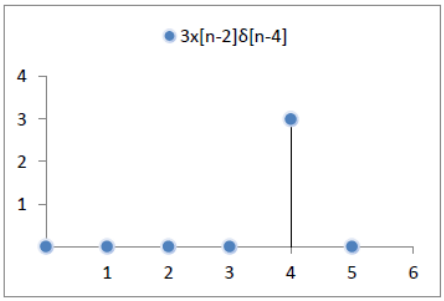






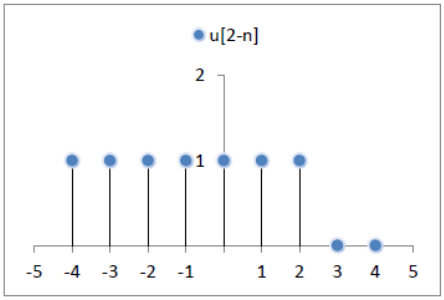
d) $\boldsymbol{3x[n-2]\delta[n-4]}$

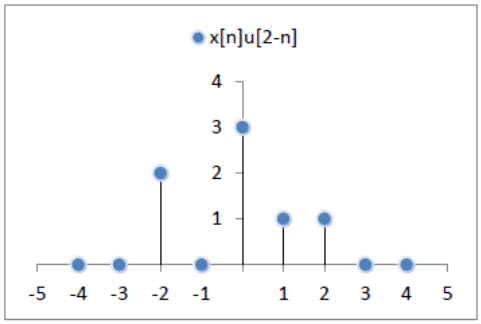
Multiplying a signal $x[n]$ by $\delta[n+k]$ zeros all samples except that at $n=-k$.



e) $\boldsymbol{x[n]u[2-n]}$

First, $u[-n+2]$ is obtained from $u[n]$ through a left shift by 2 samples then mirroring the signal relative to the y-axis. The two signals $x[n]$, $u[2-n]$ are then multiplied together on a sample-by-sample basis.





f) $x[n^2]$

Through simple substitution:

$y[-2] = x[4] = 0$, $y[-1] = x[1] = 1$, $y[0] = x[0] = 3$, $y[1] = x[1] = 1$, $y[2] = x[4] = 0$