H.W 2

רום הירש – 313288763

שאלות 1 + 2 :

1)

$z_1 = u[n] - u[n-L]$

$z_2 = \delta[n-L]$

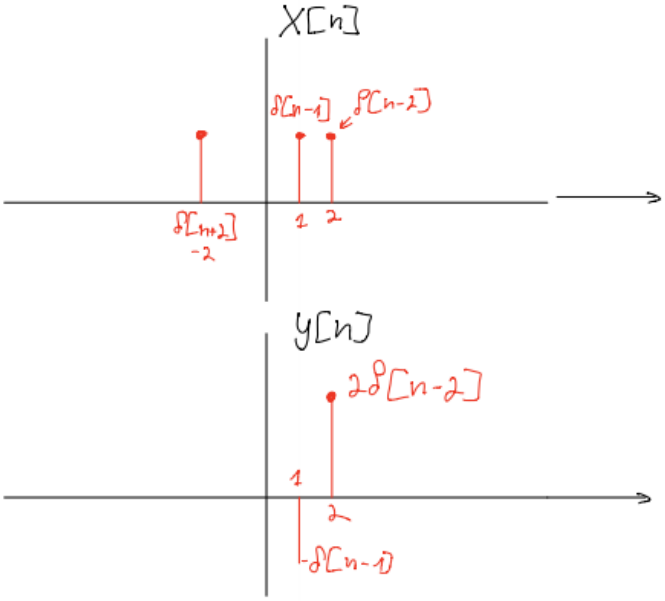
$z_1 * z_2 = u[n-L] - u[n-2L]$

2)

$x[n] = \delta[n+2] + \delta[n-1] + \delta[n-2]$

$y[n] = -\delta[n-1] + 2\delta[n-2]$

$y[n-k] = -\delta[n-k-1] + 2\delta[n-2-k]$

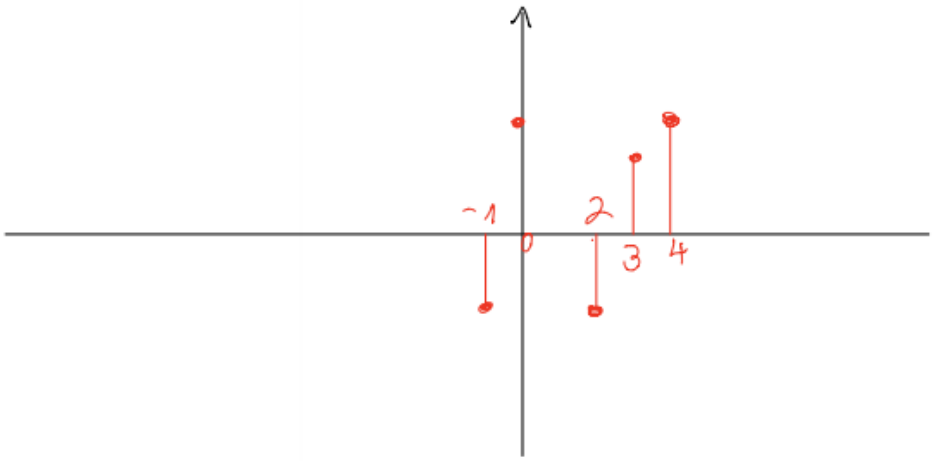


$$h[n] = x[n] * y[n] = \sum_{k=-\infty}^{\infty} x[k] \cdot y[n-k]$$

$$h[n] = \begin{cases} 0 & n-1 < -2 \\ 0 & n-2 > 2 \\ \text{overlap} & \text{else} \end{cases}$$

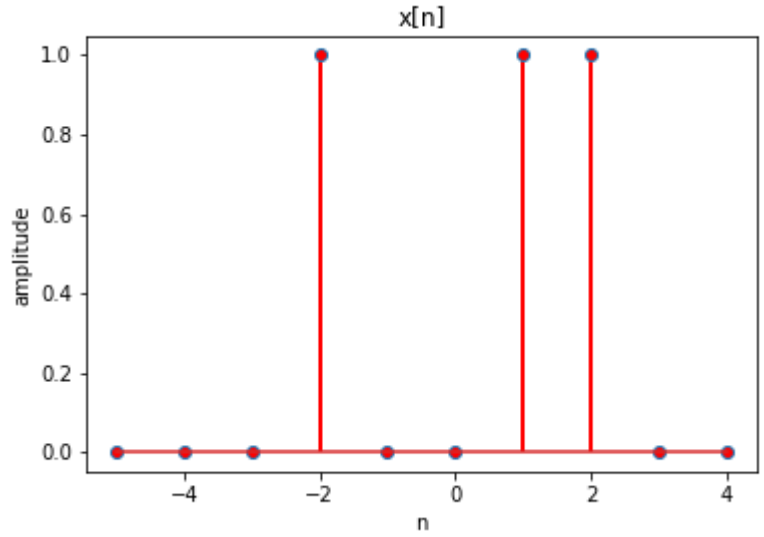
$n - 1 = -2 \Rightarrow n = -1 \qquad h[-1] = -1$

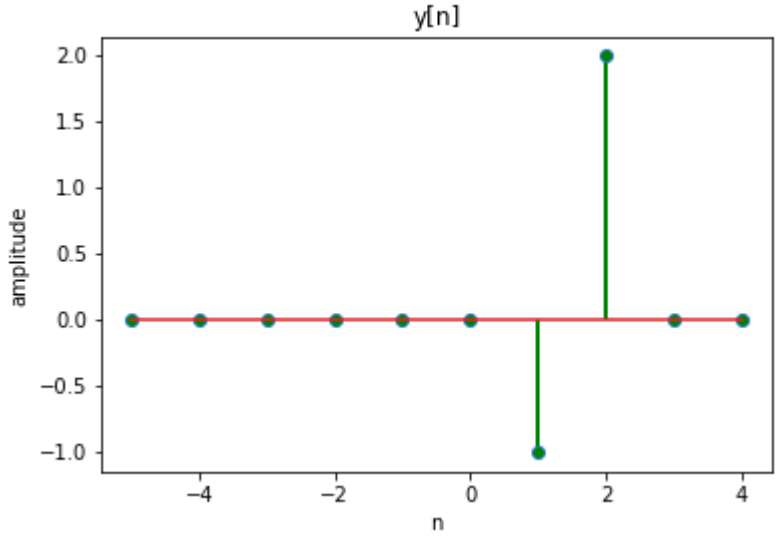
$n = 0 \qquad h[0] = 2$
$n = 1 \qquad h[1] = 0$
$n = 2 \qquad h[2] = -1$
$n = 3 \qquad h[3] = 1$
$n - 2 = 2 \Rightarrow n = 4 \qquad h[4] = 2$

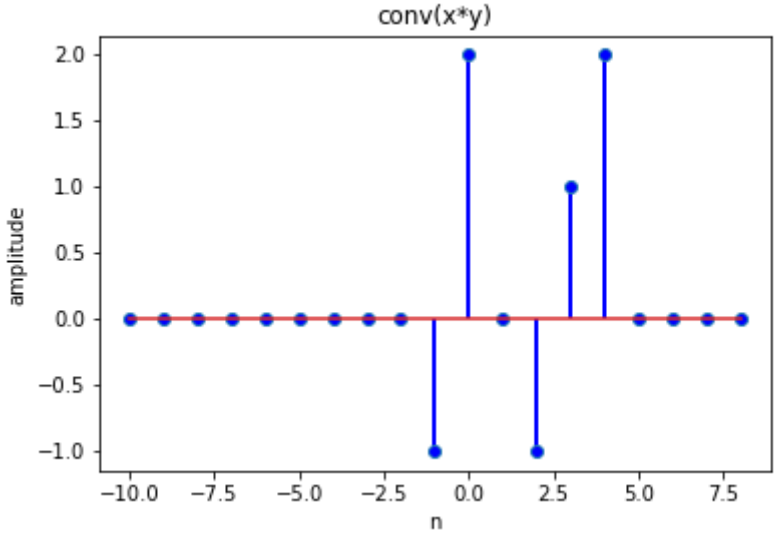


שאלה 3 :

להלן הplot הקוד כתוב למטה במסמך







שאלה 4 :

4)

$$h[n] = u[n] - u[n-3] + \frac{1}{2}\delta[n-35] = \delta[n] + \delta[n-1] + \delta[n-2] + \delta[n-35]$$

$$x[n] = 2u[n+2] - 2u[n-30]$$

$$h[n] * x[n] = x[n] + x[n-1] + x[n-2] + \frac{1}{2}x[n-35]$$

שאלה 5 + 6 :

5.

$$h[n] = \left(\frac{1}{4}\right)^n u[n]$$

$$x[n] = \left(\frac{1}{3}\right)^n (u[n] - u[n-5]) \Rightarrow x[n] = \sum_{x=0}^{4} \left(\frac{1}{3}\right)^n \delta[n-x]$$

$$x[n] = \delta[n] + \frac{1}{3}\delta[n-1] + \frac{1}{9}\delta[n-2] + \frac{1}{27}\delta[n-3] + \frac{1}{81}\delta[n-4]$$

$$y[n] = h[n] * x[n] = h[n] + \frac{1}{3}h[n-1] + \frac{1}{9}h[n-2] + \frac{1}{27}h[n-3] + \frac{1}{81}h[n-4]$$

$$y[n] = \left(\frac{1}{4}\right)^n u[n] + \frac{1}{3}\left(\frac{1}{4}\right)^{n-1} u[n-1] + \frac{1}{9}\left(\frac{1}{4}\right)^{n-2} u[n-2] + \frac{1}{27}\left(\frac{1}{4}\right)^{n-3} u[n-3] + \frac{1}{81}\left(\frac{1}{4}\right)^{n-4} u(n-4)$$

ב.

$$y[4] = \frac{1}{4}^4 u(4) + \frac{1}{3}\cdot\frac{1}{4}^3 u(3) + \frac{1}{9}\cdot\frac{1}{4}^2 u(2) + \frac{1}{27}\cdot\frac{1}{4} u(1) + \frac{1}{81}\cdot\frac{1}{4}^0 \cdot u(0)$$

$$y[4] = \frac{1}{4}^4 + \frac{1}{3}\cdot\frac{1}{4}^3 + \frac{1}{9}\cdot\frac{1}{4}^2 + \frac{1}{27}\cdot\frac{1}{4} + \frac{1}{81}\cdot$$

6)

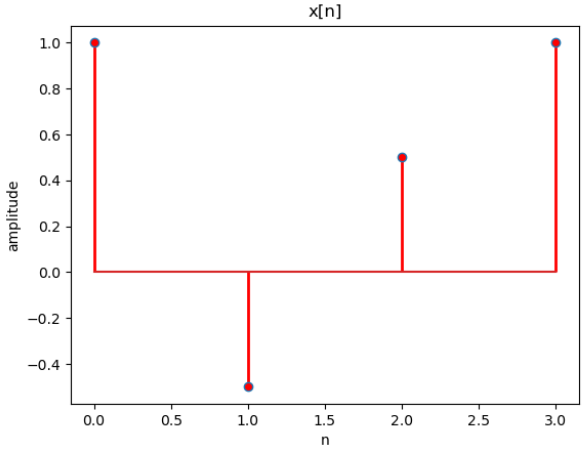
$$x[n] \rightarrow \boxed{h[n]} \rightarrow y[n]$$

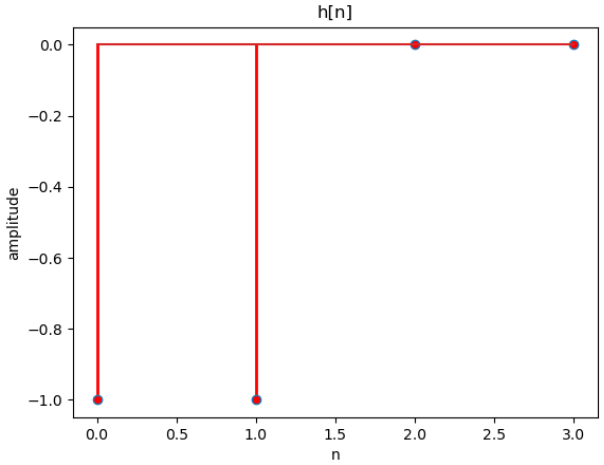
$$y[n] = x[n] * h[n] = -1[1, -\tfrac{1}{2}, \tfrac{1}{2}, 1] - 1[1, 1, -\tfrac{1}{2}, \tfrac{1}{2}] = [-2, -\tfrac{1}{2}, 0, -1\tfrac{1}{2}]$$

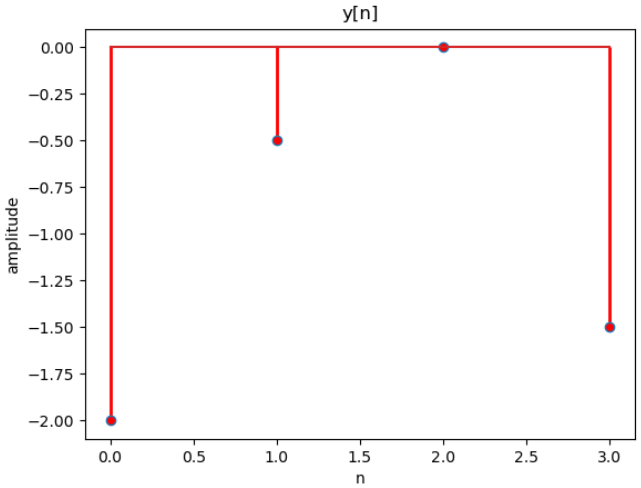
שאלה 7 –

להלן הplot הקוד כתוב למטה במסמך

*כתבתי את הפונקציה של cycle cov (ccov) כי לא מצאתי פונקציה מוכנה בpython







קוד – python שאלה 3 ו7 –

```python
import matplotlib.pyplot as plt
from scipy import signal
import numpy as np
#%%
"""
Q -

x[n]=delta[n+2]+delta[n-1]+delta[n-2]
y[n]=-delta[n-1]+2delta[n-2]
"""

Vlen = 10 #len vector
#plot stem with color
def stem_plot(n,val,color):
markerline1, stemlines1, baseline1 = plt.stem(n,val)
plt.setp(markerline1, 'markerfacecolor', color)
plt.setp(stemlines1, linestyle="-", color=color, linewidth=2 )


#create Delta
def dirac(val=0):
zero = Vlen/2
return signal.unit_impulse(Vlen,int(zero-val))

def plotStem(title,ylabel,xlabel,color,x,y):
plt.figure()
plt.title(title)
plt.ylabel(ylabel)
plt.xlabel(xlabel)
stem_plot(x,y,color)
plt.show()

ncov = np.arange(-10,9,1)
n = np.arange(-5,5,1)
delta = signal.unit_impulse(8)
x = dirac(2)+dirac(-1)+dirac(-2) # x[n]=delta[n+2]+delta[n-1]+delta[n-2]
y = -dirac(-1)+2*dirac(-2) # y[n]=-delta[n-1]+2delta[n-2]
plotStem("x[n]","amplitude","n",'red',n,x)
plotStem("y[n]","amplitude","n",'green',n,y)
convXY = np.convolve(x,y)
plotStem("conv(x*y)","amplitude","n",'blue',ncov,convXY)
#%%
"""
Q - 7

x=[1 -0.5 0.5 1];
h=[-1 -1 0 0];

"""
#function

def padded_zeros(arr,N): # padded zeros
padded_array = np.zeros(N)
padded_array[:len(arr)]+=arr
return padded_array
```

```
56
57
58 #cycle Covolation
59 def ccov(x,y):
60 #check which array more large and pandded with zeros the others
61 N=len(x)
62 if len(x)>len(y):
63 N=len(x)
64 y = padded_zeros(y,N)
65 else:
66 N=len(y)
67 x = padded_zeros(x,N)
68 h = np.zeros(N) # check h[n] vector
69 for n in range(N):
70 for k in range(N):
71 h[n]+=y[k]*x[(n-k)%N]
72 return h
73
74 n = np.arange(0,4,1)
75 x=np.array([1,-0.5,0.5,1])
76 h=np.array([-1,-1,0,0])
77 y = ccov(x,h) # cycle convolation
78 plotStem("x[n]","amplitude","n",'red',n,x)
79 plotStem("h[n]","amplitude","n",'red',n,h)
80 plotStem("y[n]","amplitude","n",'red',n,y)
```