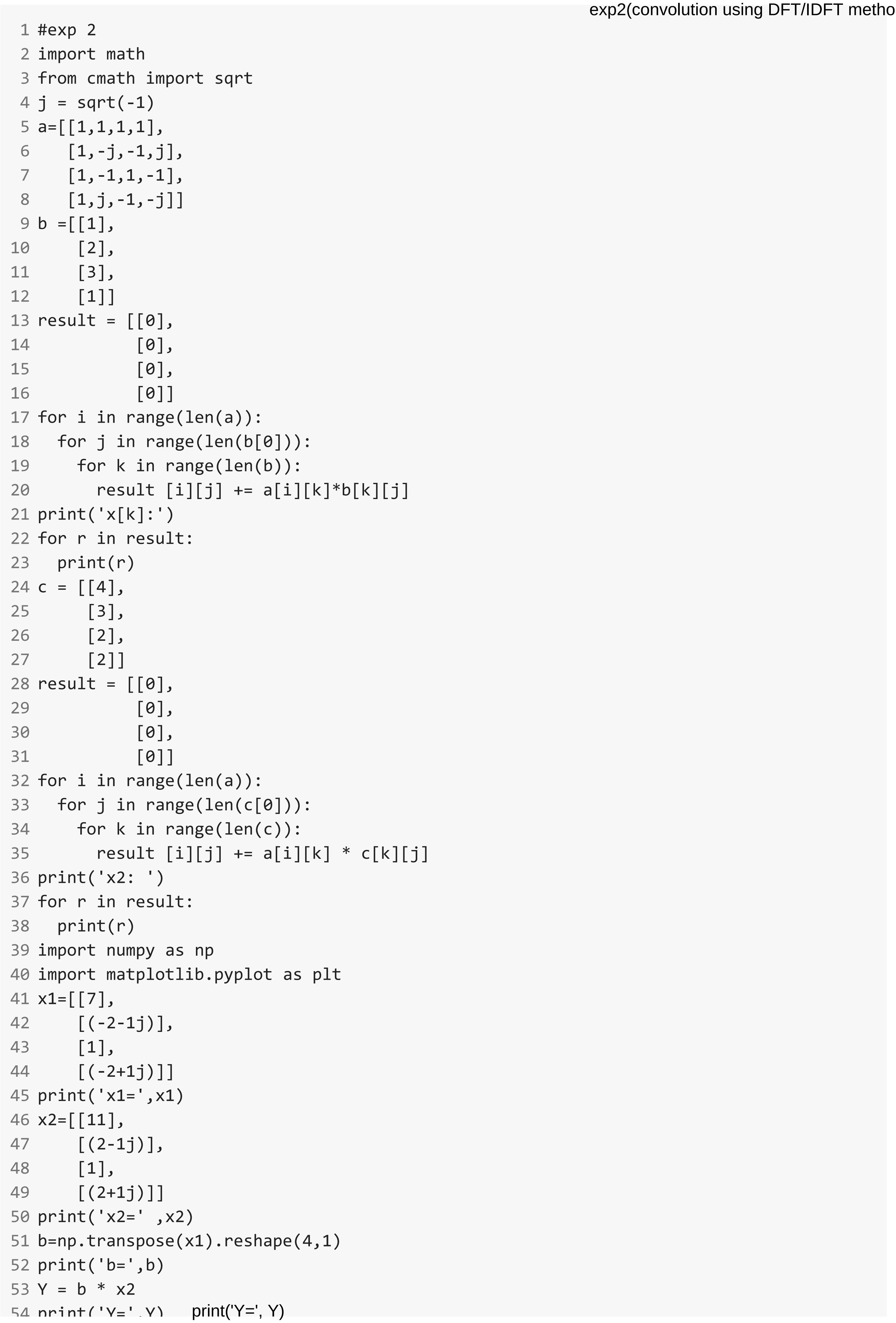
exp1(DFT/IDFT of given digital signal)

```
import math
from cmath import sqrt
j= sqrt(-1)
a=[[1,1,1,1],
[1,-j,-1,j],
[1,-1,1,-1],
[1,j,-1,-j]]
b=[[1],
[-1],
[2],
[-2]]
result= [[0],
[0],
[0],
[0]]
for i in range(len(a)):
  for j in range(len(b[0])):
    for k in range(len(b)):
      result[i][j] += a[i][k] * b[k][j]
print('X[k]:  ')
for r in result:
  print(r)
import math
from cmath import sqrt
j = sqrt(-1)
a=[[0.25,0.25,0.25,0.25],
[0.25,0.25j,-0.25,-0.25j],
[0.25,-0.25,0.25,-0.25],
[0.25,-0.25j,-0.25,0.25j]]
b = [[4],
[2],
[0],
[4]]
result = [[0],
[0],
[0],
[0]]
for i in range(len(a)):
  for j in range(len(b[0])):
    for k in range(len(b)):
      result[i][j] += a[i][k] * b[k][j]
print('x(n): ')
for r in result:
  print(r)
```

```
X[k]:
[0]
[(-1-1j)]
[6]
[(-1+1j)]
x(n):
[2.5]
[(1-0.5j)]
[-0.5]
[(1+0.5j)]
```

exp2(convolution using DFT/IDFT method)



```
#exp 2
import math
from cmath import sqrt
j = sqrt(-1)
a=[[1,1,1,1],
   [1,-j,-1,j],
   [1,-1,1,-1],
   [1,j,-1,-j]]
b =[[1],
    [2],
    [3],
    [1]]
result = [[0],
          [0],
          [0],
          [0]]
for i in range(len(a)):
  for j in range(len(b[0])):
    for k in range(len(b)):
      result [i][j] += a[i][k]*b[k][j]
print('x[k]:')
for r in result:
  print(r)
c = [[4],
     [3],
     [2],
     [2]]
result = [[0],
          [0],
          [0],
          [0]]
for i in range(len(a)):
  for j in range(len(c[0])):
    for k in range(len(c)):
      result [i][j] += a[i][k] * c[k][j]
print('x2: ')
for r in result:
  print(r)
import numpy as np
import matplotlib.pyplot as plt
x1=[[7],
    [(-2-1j)],
    [1],
    [(-2+1j)]]
print('x1=',x1)
x2=[[11],
    [(2-1j)],
    [1],
    [(2+1j)]]
print('x2=' ,x2)
b=np.transpose(x1).reshape(4,1)
print('b=',b)
Y = b * x2
print('Y=',Y)
```

print('Y=', Y)

```
print('Y:',Y)
plt.stem(Y)
plt.show()
import math
from cmath import sqrt
import matplotlib.pyplot as plt
j = sqrt(-1)
a= [[0.25,0.25,0.25,0.25]
    [0.25,0.25j,-0.25,-0.25j]
    [0.25,-0.25,0.25,-0.25]
    [0.25,-0.25j,-0.25,0.25j]]
Y = [[77],
     [-5],
     [1],
     [-5]]
result = [[0],
          [0],
          [0],
          [0]]
for i in range(len(a)):
  for j in range(len(Y[0])):
    for k in range(len(Y)):
      result[i][j] += a[i][k] * Y[k][j]
print('Y(n):')
for r in result:
  print(r)
plt.stem(r)
plt.show()
```

```
clear all;
X0=1;
X1=2;
X2=3;
X3=4;
X4=4;
X5=3;
X6=2;
X7=1;
N=8
W80=1;
W81= 0.707 - 1i*0.707
W82= -1j;
W83=-0.707-1i*0.707;
% stage 01
S10= X0+ X4*W80
S11=X0-X4*W80
S12=X2+X6*W80
S13=X2-X6*W80
S14=X1+X5*W80
S15=X1-X5*W80
S16=X3+X7*W80
S17=X3-X7*W80
% stage 02
S20=S10+S12*W80
S21=S11+S13*W82
S22=S10-S12*W80
S23=S11-S13*W82
S24=S14+S16*W80
S25=S15+S17*W82
S26=S14-S16*W80
S27=S15-S17*W82
% stage 03
X10=S20+S24*W80
X11=S21+S25*W81
X12=S22+S26*W82
X13=S23+S27*W83
X14=S20-S24*W80
X15=S21-S25*W81
X16=S22-S26*W82
X17=S23-S27*W83
```

exp3(b)IDFT using DIF FFT algorithm

```
clear all;
x0=20;
x1=-5.828-1i*2.414;
x2=0;
x3=-0.172-1i*0.414;
x4=0;
x5=-0.172+1i*0.414;
x6=0;
x7=-5.828+1i*2.414;
N=8;
W80=1;
W81=0.707+1i*0.707;
W82=1i;
W83=-0.707+1i*0.707;
%stage 01
S10=x0+x4
S11=x1+x5
S12=x2+x6
S13=x3+x7
S14=(x0-x4)*W80
S15=(x1-x5)*W81
S16=(x2-x6)*W82
S17=(x3-x7)*W83
%stage 02
S20=S10+S12
S21=S11+S13
S22=(S10-S12)*W80
S23=(S11-S13)*W82
S24=S14+S16
S25=S15+S17
S26=(S14-S16)*W80
S27=(S15-S17)*W82
%stage 03
X0=1/N*(S20+S21)*W80
X4=1/N*(S20-S21)*W80
X2=1/N*(S22+S23)*W80
X6=1/N*(S22-S23)*W80
X1=1/N*(S24+S25)*W80
X5=1/N*(S24-S25)*W80
X3=1/N*(S26+S27)*W80
X7=1/N*(S26-S27)*W80
```

exp4(Freqz response of Differential equation Form)

```
num=[1,1];
den=[1];
w=0:pi/200:2*pi
H=2*exp(-j*5*w).*cos(5*w)
subplot(2,1,1);
plot(w,abs(H));
xlabel('w')
ylabel('magnitude')
subplot(2,1,2);
plot(w,angle(H));
xlabel('w')
ylabel('phase')
```

exp5(window technique)

```
HAMMING WINDOW
n=[0 1 2 3 4 5 6 ];
N= 7;
W= 0.54-0.46*cos(2*pi*n/6)
hdn = (sin((3*pi/4)*(n-3)))./(pi*(n-3))
hn=hdn.*W

RECTANGULAR WINDOW
n=[0 1 2 3 4 5 6 ];
N= 7;
W= 1
hdn = (sin((3*pi/4)*(n-3)))./(pi*(n-3))
hn=hdn.*W

HANNING WINDOW
n=[0 1 2 3 4 5 6 ];
N= 7;
W= 0.5-0.5*cos(2*pi*n/6)
hdn = (sin((3*pi/4)*(n-3)))./(pi*(n-3))
hn=hdn.*W

BLACKMAN WINDOW
n=[0 1 2 3 4 5 6 ];
N= 7;
W= 0.42-0.5*cos(2*pi*n/6) + 0.08*cos(4*pi*n/6)
hdn = (sin((3*pi/4)*(n-3)))./(pi*(n-3))
hn=hdn.*W
```

exp6(LP IIR filter)

```
clc;
clear all;
close all;
disp('enter the IIR filter desing specifications');
rp=input("enter the passband ripple:");
rs=input("enter the stopband ripple:");
wp=input("enter the passband freq:");
ws=input("enter the stopband freq:");
fs=input("enter sampling freq:");
W1=2*wp/fs;W2=2*ws/fs;
[n,wn]=buttord(W1,W2,rp,rs,'s');
disp('frequncy response of IIR LPF is;');
[b,a]=butter(n,wn,'low','s');
w=0:.01:pi;
[h,om]=freqs(b,a,w);
m=20*log10(abs(h));
an=angle(h);
figure,subplot(2,1,1);plot(om/pi,m);
title('magnitude response of IIR filter is');
xlabel('(a)Normalized freq.-->');
ylabel('Gain in dB-->');
subplot(2,1,2);plot(om/pi,an);
title('phase response of IIR filter is');
xlabel('(b)Normalized freq.-->');
ylabel('phase in radians-->');


command window ---
enter the passband ripple:
15
enter the stopband ripple:
60
enter the passband freq:
1500
enter the stopband freq:
3000
enter sampling freq:
7000
```

exp7(sound signal)

```
clc;
close all;
y1=audioread('/homw/computer/Music/file_example_WAV_2MG.wav')
subplot(2,1,1);
plot(y1)
title('Original Test Signal');
grid on;
t=awgn(y1,10,'measured');
y2=y1.*t;
subplot(2,1,2);
plot(y2)
title('Signal with noise');
grid on;
```

exp8(Decimation process)

```
clc;
clear all;
close all;
D = input ("Enter the downsampling factor:");
L = input ("Enter the length of input sequence:");
f1 = input ("Enter the frequency of first sinusoidal:");
f2 = input ("Enter the frequency of second sinusoidal:");
n = 0:L-1;
x = sin(2*pi*f1*n)+sin(2*pi*f2*n);
y = decimate(x,D,'fir');
subplot(2,1,1); stem (n,x(1:L));
title ("input sequence; x");
xlable('time, n');
ylable('amplitude');
m=0: (L/D)-1;
subplot(2,1,2); stem (m,y(1:L/D));
title('decimated sequence, y');
xlable('time, n');
ylable('amplitude');
```

command window

```
Enter the downsampling factor:
5
Enter the length of input sequence:
100
Enter the frequency of first sinusoidal:
0.01
Enter the frequency of second sinusoidal:
0.03
```