EE3015 Assignment-1

Krishna Srikar Durbha - EE18BTECH11014

1 Problem

1.1. Let

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (1.1.1)$$

$$y(n) + \frac{1}{2} y(n-1) = x(n) + x(n-2) \quad (1.1.2)$$

1.2. Compute

$$X(k) \triangleq \sum_{n=0}^{N-1} x(n) e^{-j2\pi kn/N}, \quad k = 0, 1, \ldots, N-1 \quad (1.2.1)$$

and $H(k)$ using h(n).

2 Solution

2.1.

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (2.1.1)$$

$$y(n) + \frac{1}{2} y(n-1) = x(n) + x(n-2) \quad (2.1.2)$$

Impulse Response of the LTI system is the output of the system when Unit Impulse Signal is given as input to the system.

So, Impulse Response of the System is

$$h(n) + \frac{1}{2} h(n-1) = \delta(n) + \delta(n-2) \quad (2.1.3)$$

2.2. DFT of a Input Signal $x(n)$ is

$$X(k) \triangleq \sum_{n=0}^{N-1} x(n) e^{-j2\pi kn/N}, \quad k = 0, 1, \ldots, N-1 \quad (2.2.1)$$

2.3. DFT of a Impulse Response $h(n)$ is

$$H(k) \triangleq \sum_{n=0}^{N-1} h(n) e^{-j2\pi kn/N}, \quad k = 0, 1, \ldots, N-1 \quad (2.3.1)$$

2.4. Code for Computing DFT of $x(n)$ and $h(n)$
Solution:

```
import numpy as np
import matplotlib.pyplot as plt

def h(N):
    h = []
    for i in range(N):
        o = 0;
        if i >= 0:
            o += pow(-0.5,i)
        if i-2 >= 0:
            o += pow(-0.5,i-2)
        h.append(o)

    return h

def DFT(s):
    S = []
    N = len(s)
    for k in range(N):
        o = 0 * 1j
        for n in range(N):
            o += s[n] * np.exp(-1j*2*
                np.pi*k*n/N)
        S.append(o)
    return S

x = [1,2,3,4,2,1]
N = len(x)
h = h(N)

print ("DFT of x(n)\n",DFT(x))
print()
print ("DFT of h(n)\n",DFT(h))
```

The above code is in

codes/ee18btech11014.py