

ITU Computer and Informatics Faculty  
BLG 354E Signals and Systems for  
Computer Engineering -2020 Spring  
Homework-1

O. Kürşat Karayılan  
150140011

1a)

a)

$$2x[n] = y[n] + \frac{3}{2}y[n-1]$$
$$y[n] = 2x[n] - \frac{3}{2}y[n-1]$$

since system is causal  $h[-1] = 0$

$$h[n] = 2\delta[n] - \frac{3}{2}h[n-1]$$
$$h[0] = 2$$
$$h[1] = -3$$
$$h[2] = 4.5$$
$$h[3] = -6.75$$
$$h[4] = 10.125$$
$$\vdots$$
$$h[n] = \{2, -3, 4.5, -6.75, \dots\}$$

1b)

$$f(n-1) = u(n-1) - u(n-2)$$

$$\begin{aligned} x[n] &= u[n] - u[n-2] + 2u[n-1] - 2u[n-2] \\ &= u[n] - 3u[n-2] + 2u[n-1] \end{aligned}$$



$$y[n] = x[n] * h[n]$$

$$n = 0 \text{ to } 5$$

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

$$x[-1] = 0$$

$$x[0] = 1$$

$$x[1] = 3$$

$$x[2] = 0$$

$$x[3] = 0$$

$$y[n] = h[n] + 3h[n-1] \quad n = 0 \text{ to } 5$$

$$y[0] = 2$$

$$y[2] = -4.5$$

$$y[5] = 15.18$$

$$y[1] = -3 + 6 = 3$$

$$y[3] = 6.75$$

$$y[4] = -10.125$$

2a)

$$\frac{1}{3}x[n-2] + \frac{1}{3}x[n-1] + \frac{x[n]}{3} = y[n]$$

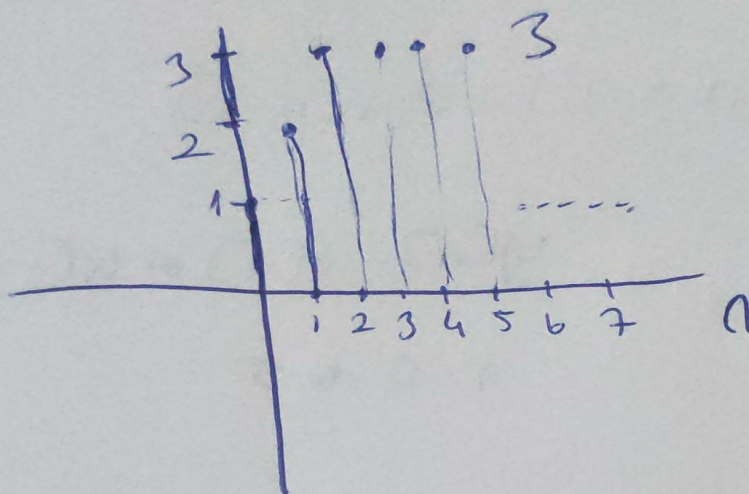
$$y(z) = \left( \frac{z^{-2}}{3} + \frac{z^{-1}}{3} + \frac{z}{3} \right) x(z)$$

$$T(z) = \frac{y(z)}{x(z)} = \frac{z^{-2} + z^{-1} + z}{3}$$

$$= \frac{z^3 + z + 1}{3z^2}$$

2b)

$$u[n] + u[n-1] + u[n-2] = y[n]$$



2c)

```
filter(an):  
    X = an  
    Y = an-1  
    Z = an-2  
    return (x+y+z)/3
```

3)

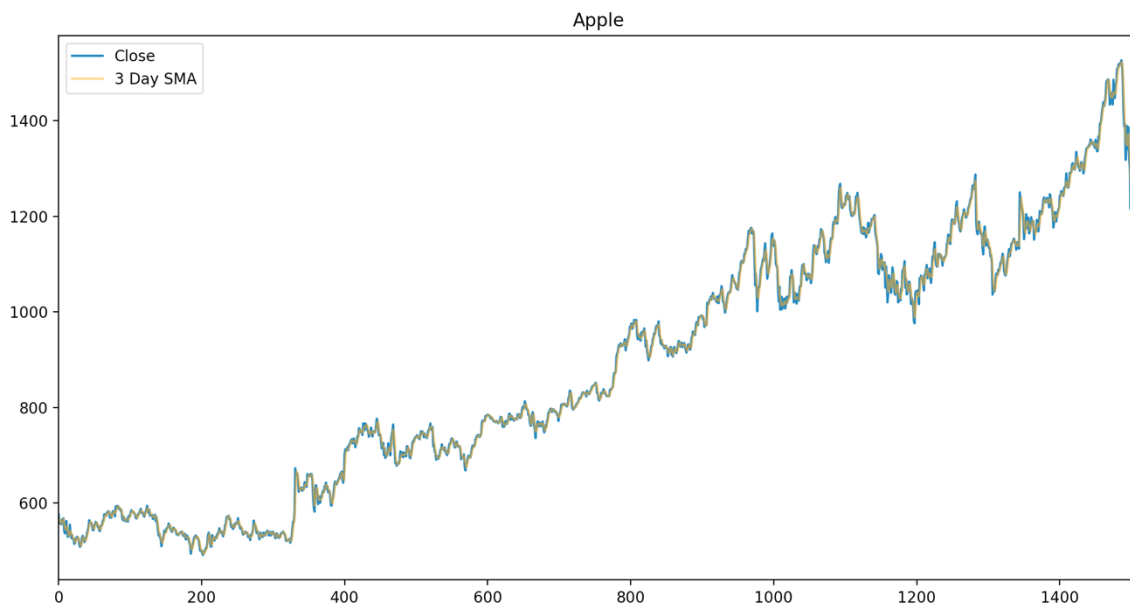
You can run the program with command line:

```
python q3.py
```

You should see output like below image.

```
Please enter date interval. If you enter blank input to first date, default will  
be all dates.  
  
Enter first date(YYYY-MM-DD):
```

If you just press enter it calculated all dates. Then you will see a chart on popup screen like below.



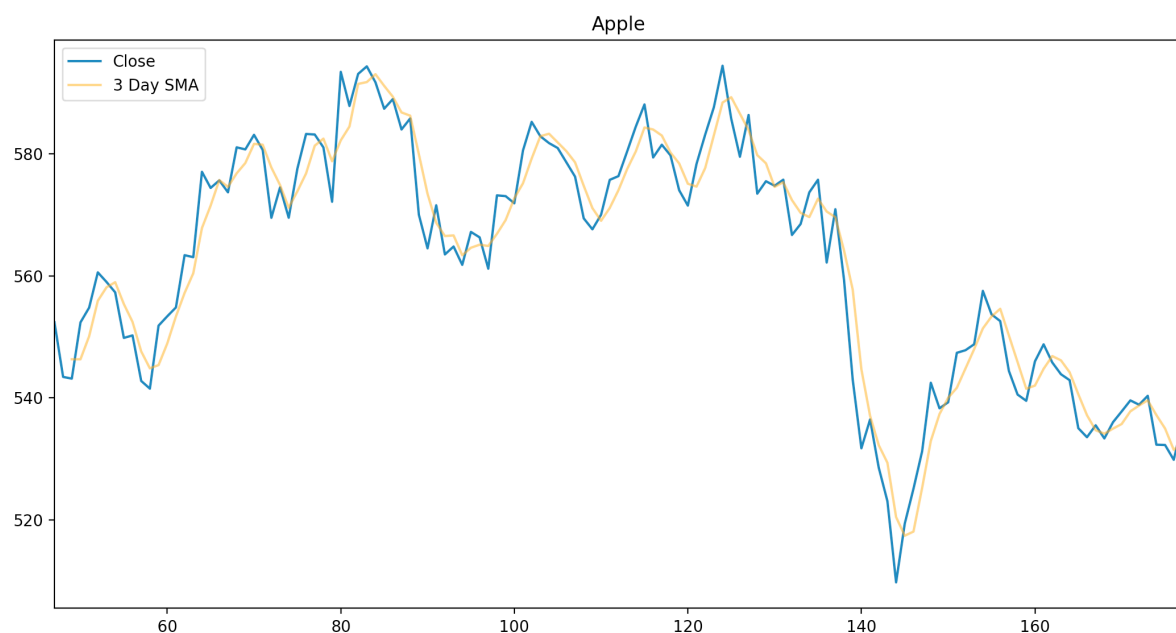
And it calculates other values then prints on command line.

```
Please enter date interval. If you enter blank input to first date, default will be all dates.
```

```
Enter first date(YYYY-MM-DD):  
Average val: 884.2701005969539  
Standard deviation val: 263.245447322257  
Root mean square val: 922.5973736648466
```

If you want to enter time interval you should enter with right format.  
It is YYYY-MM-DD

Lets try between dates 2014-06-01 and 2014-12-04. You will see the graph for desired time interval.



You can see calculations as well.

```
Enter first date(YYYY-MM-DD): 2014-06-01  
Enter second date(YYYY-MM-DD): 2014-12-04  
Average val: 562.3881656870228  
Standard deviation val: 19.687380517534603  
Root mean square val: 562.7300268615802  
(base) Kursat-MacBook-Pro:hw1 kursat$
```