Lab Report – 2

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Question – 1

Output for the given different inputs for p:

p = [3] :

N = 2

ROC :

0 3

3 Inf

C :

0

1

S :

1

0

p = [0.1] :

N = 2

ROC :

0 0.1000

0.1000 Inf

C :

    0

    1

S :

    0

    1

p = [0] :

N = 1

ROC :

    0   Inf

C :

    1

S :

    1

p = [0, 0.5] :

N = 2

ROC :

```
        0    0.5000
   0.5000       Inf
```

C :

    0

    1

S :

```
     0
     1
```

p = [2, -0.5] :

N = 3

ROC :

```
         0    0.5000
    0.5000    2.0000
    2.0000       Inf
```

C :

```
     0
     0
     1
```

S :

```
     0
     1
     0
```

p = [0.5, -0.5] :

N = 2

ROC :

```
         0    0.5000
    0.5000       Inf
```

C :

0

1

S :

0

1

p = [2, 2, 2] :

N = 2

ROC :

0	2
2	Inf

C :

0

1

S :

1

0

p = [0, 1, 2] :

N = 3

ROC :

0 1

1 2

2 Inf

C :

0

0

1

S :

0

0

0

p = [-0.5, 1j] :

N = 3

ROC :

0 0.5000

0.5000 1.0000

1.0000 Inf

C :

0

0

1

S :

0

0

0

p = [0, 1j, -1j] :

N = 2

ROC :

0	1
1	Inf

C :

0

1

S :

0

0

p = [0.5, -0.5, 2+1j, 2-1j] :

N = 3

ROC :

0	0.5000
0.5000	2.2361

2.2361 Inf

C :

0

0

1

S :

0

1

0

p = [1+1j, 1+2j, 1+3j, 2+1j] :

N = 4

ROC :

0	1.4142
1.4142	2.2361
2.2361	3.1623
3.1623	Inf

C :

0

0

0

1

S :

1

0

0

0

Question – 2

The poles and zeroes have been plotted using zplane() function. Frequency response has been plotted by freqz() function. Impulse response has been plotted by impz() function.

The impz() function seems to work as a low-pass filter.

Question – 3

(b) part

Question: 3 Calculating poles and zeroes

for $H(z) = \dfrac{z^2 - (2\cos\theta)z + 1}{z^2 - (2r\cos\theta)z + r^2}$

Zeroes: Roots of N^R

$$\frac{-(-2\cos\theta) \pm \sqrt{(2\cos\theta)^2 - 4}}{2} = \cos\theta \pm \sqrt{\cos^2\theta - 1}$$

$$= \cos\theta \pm i|\sin\theta|$$

Poles: Roots of D^R

$$\frac{-(-2r\cos\theta) \pm \sqrt{(-2r\cos\theta)^2 - 4r^2}}{2}$$

$$= r(\cos\theta \pm i|\sin\theta|)$$

Given that $r \in (0, 1) \Rightarrow$ ROC : $[(0, r), (r, \infty)]$

If ROC is (r, ∞), then it will include 1 and has ∞ as its bound.

Hence, it is both causal and stable.