# DSP Matlab Homework 2 Solutions

This document has been prepared for showing solutions of EHB 315E Digital Signal Processing Matlab Homework 2 by Research Assistant Hasan Hüseyin Karaoğlu

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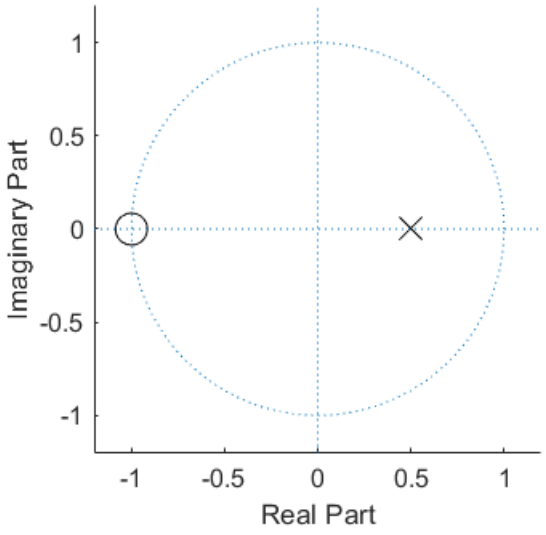
## Solution 1

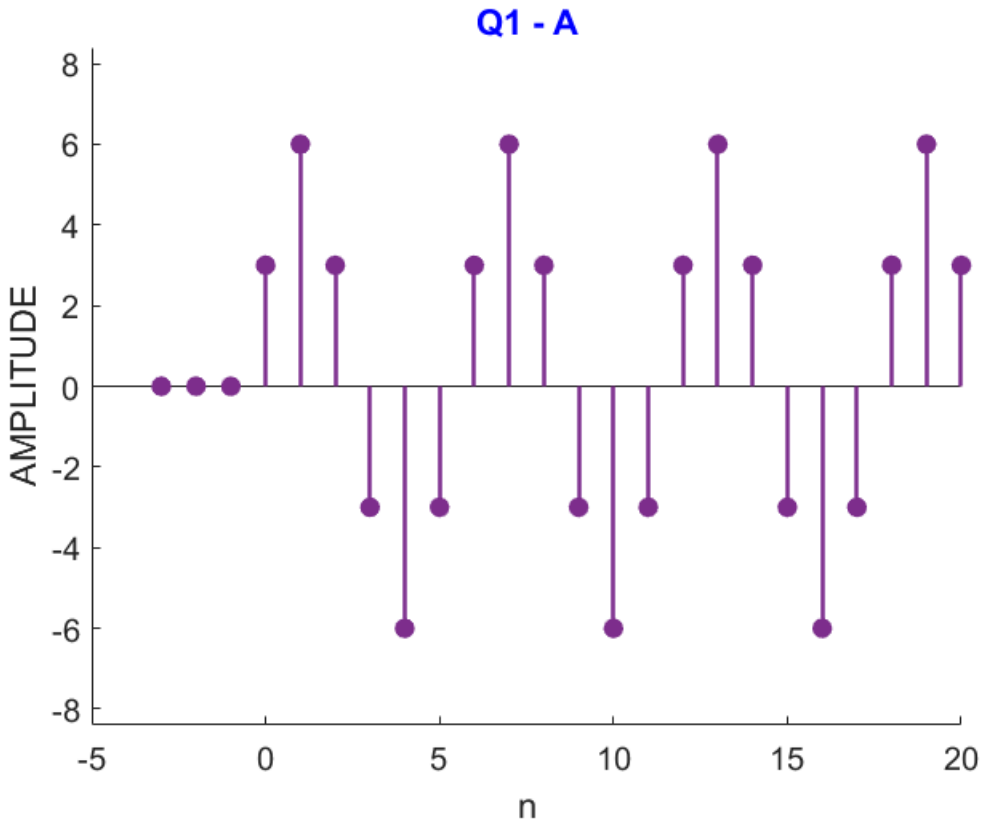
Notice that `myStem, myfreqz, myLabel, myPlot` are custom functions

```
ans =

    1 + z^-1
  ------------
  1 - 0.5 z^-1

Sample time: 0.27 seconds
Discrete-time transfer function.

Numerator Coefficients:
     3

Denominator Coefficients:
    0.5000

Gain Coefficients:
    -2
```

$$H_1(z) = -2 + \frac{3}{1 - 0.5z^{-1}}$$

$$h_1(n) = -2\delta(n) + 3(0.5)^n u(n)$$

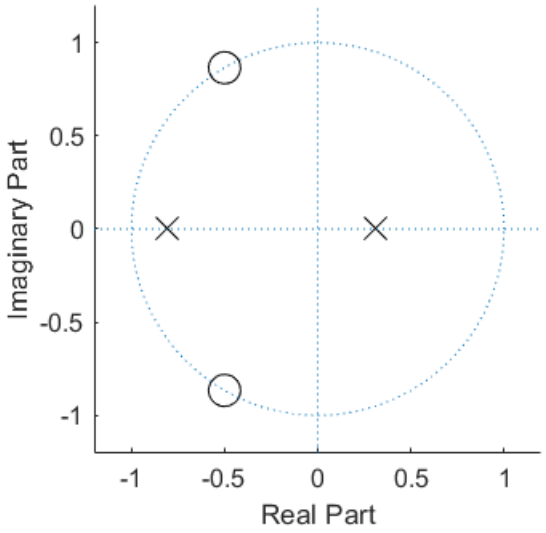


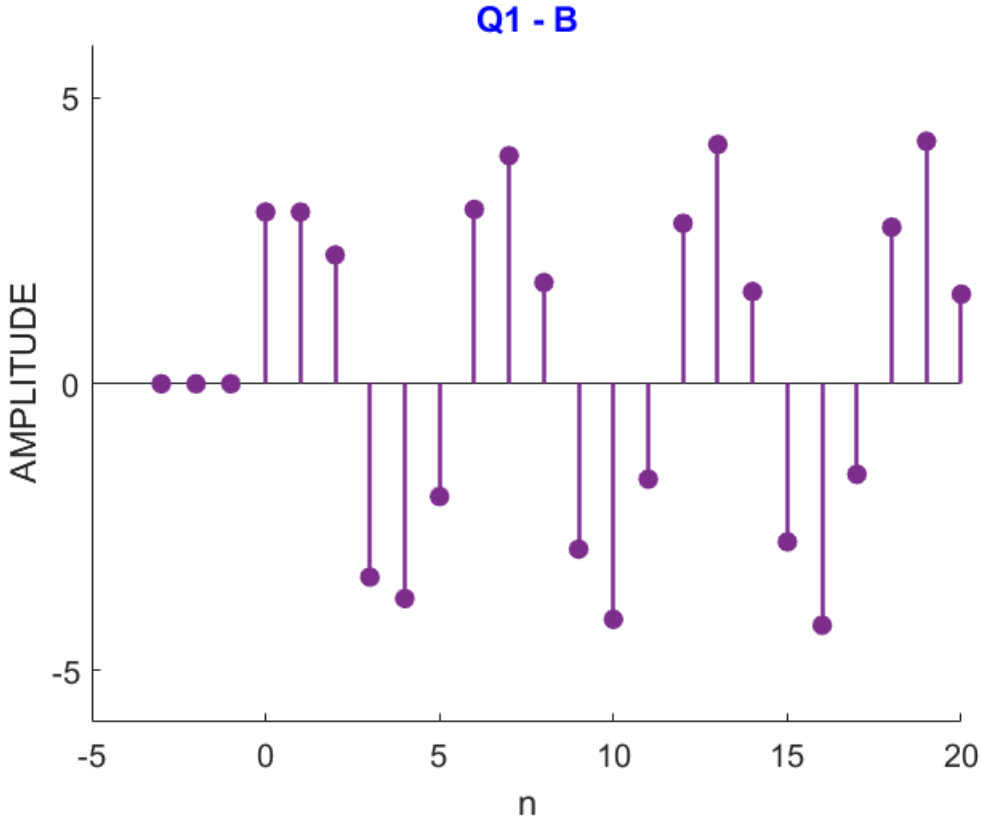



```
ans =

      1 + z^-1 + z^-2
  ------------------------
  1 + 0.5 z^-1 - 0.25 z^-2

Sample time: 0.27 seconds
Discrete-time transfer function.

Numerator Coefficients:
    0.9348
    4.0652

Denominator Coefficients:
   -0.8090
    0.3090

Gain Coefficients:
    -4
```

$$H_2(z) = -4 + \frac{0.9348}{1 + 0.809z^{-1}} + \frac{4.0652}{1 - 0.309z^{-1}}$$

$$h_2(n) = -4\delta(n) + 0.9348(-0.809)^n u(n) + 4.0652(0.309)^n u(n)$$



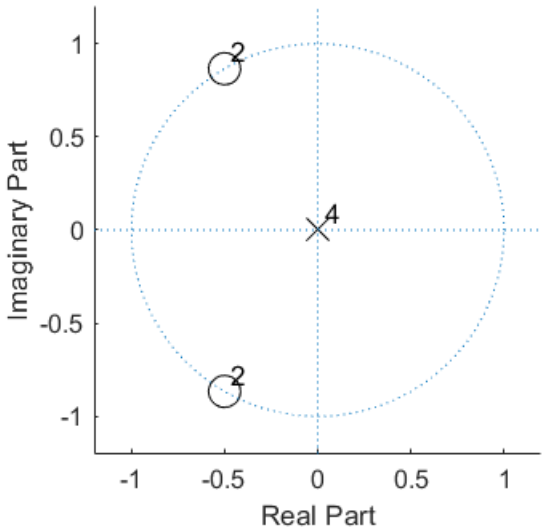



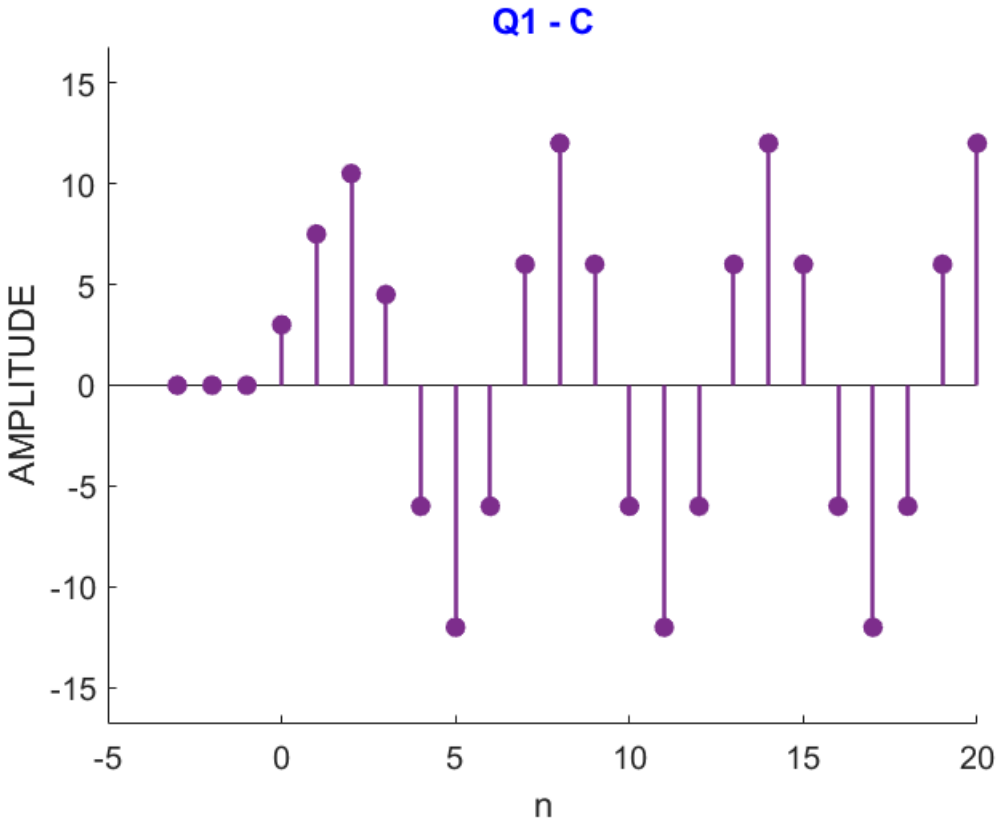

$H_3(z) = 1 + 2z^{-1} + 3z^{-2} + 2z^{-3} + z^{-4}$

$h_3(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-2) + 2\delta(n-3) + \delta(n-4)$

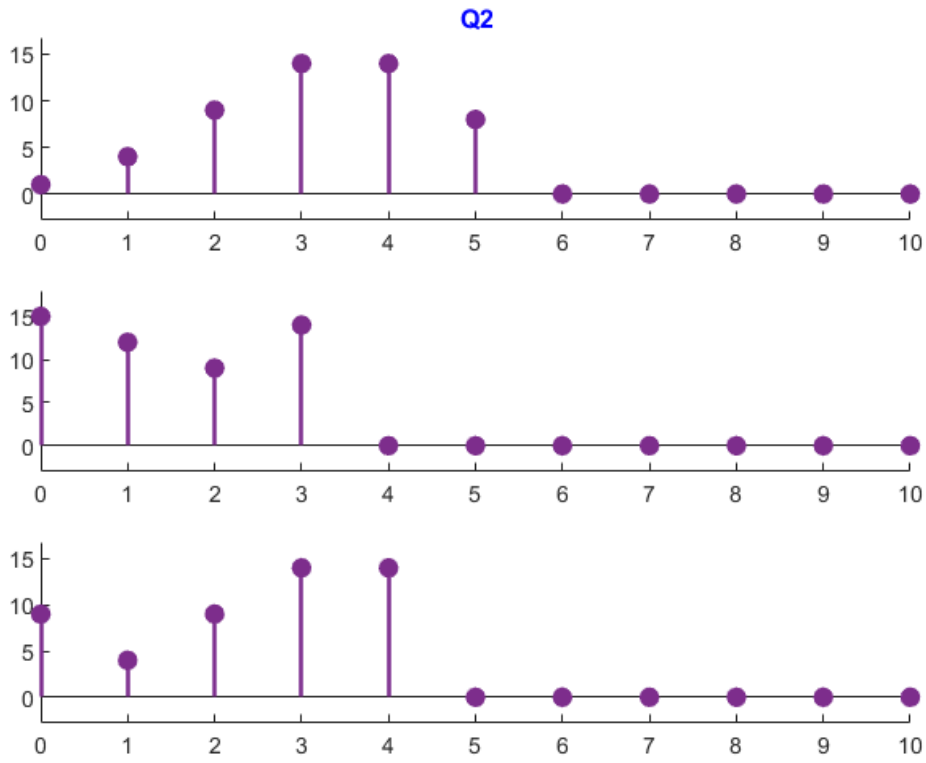
```
ans =

  1 + 2 z^-1 + 3 z^-2 + 2 z^-3 + z^-4

Sample time: 0.27 seconds
Discrete-time transfer function.
```

```
Numerator Coefficients:
Denominator Coefficients:
Gain Coefficients:
     1     2     3     2     1
```




## Solution 2



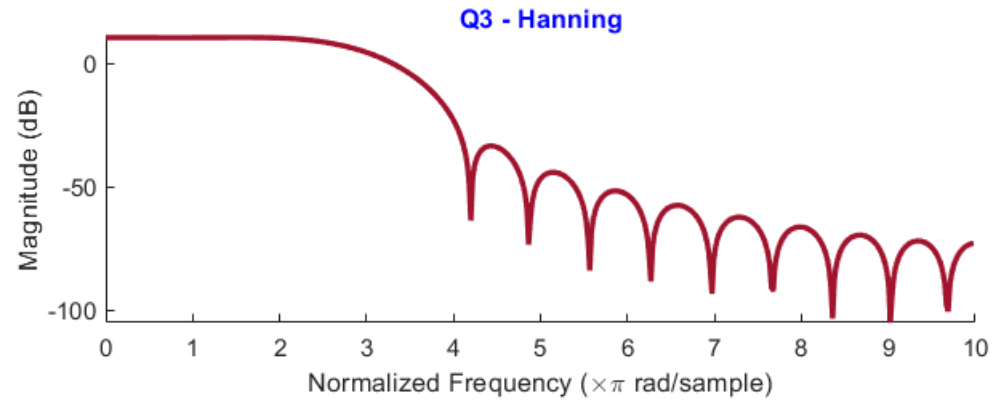

## Solution 3

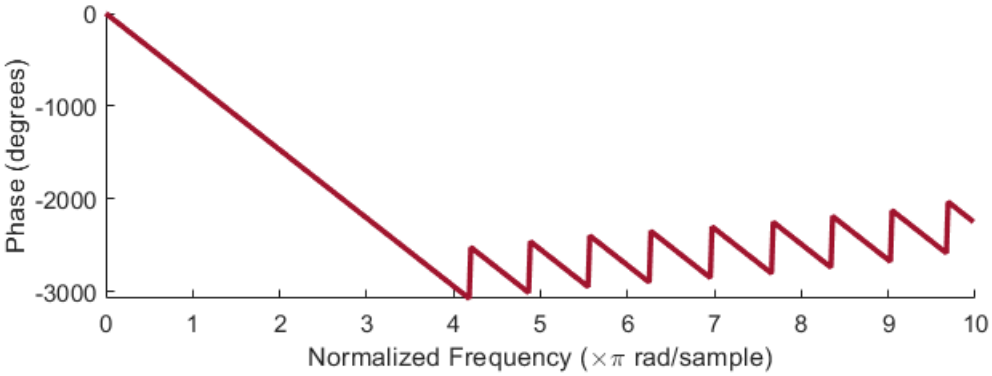
Here are desired filter specifications

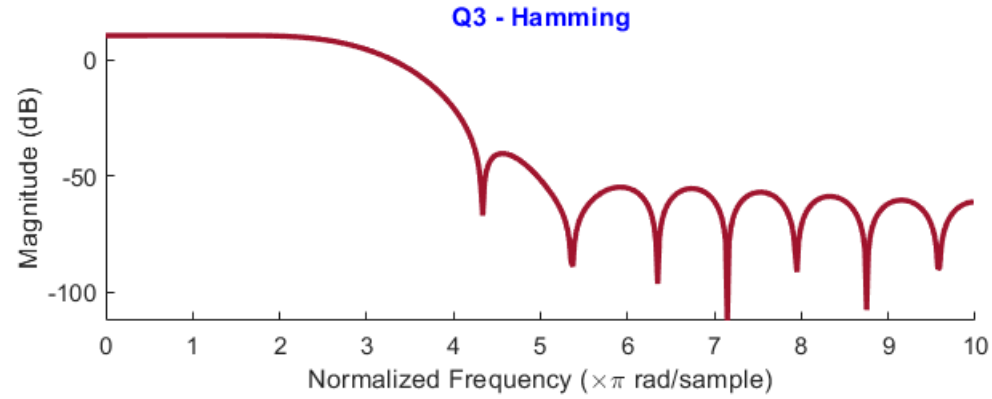
We determine the order of the filters in this section

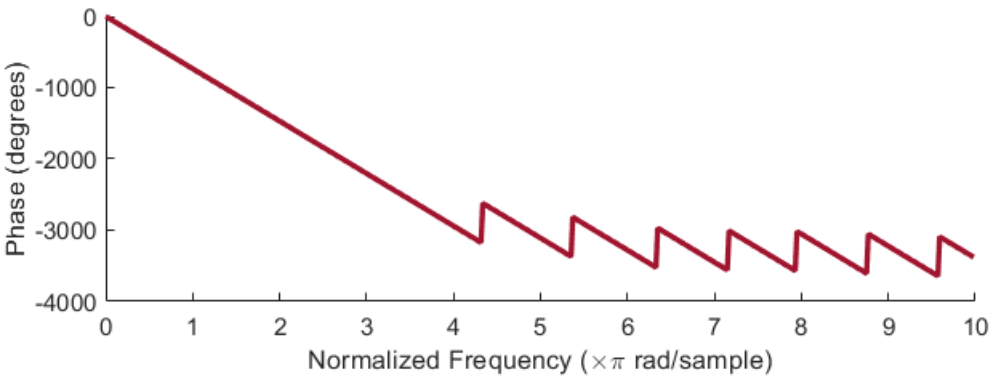
We window the sinc function our designed FIR windows.

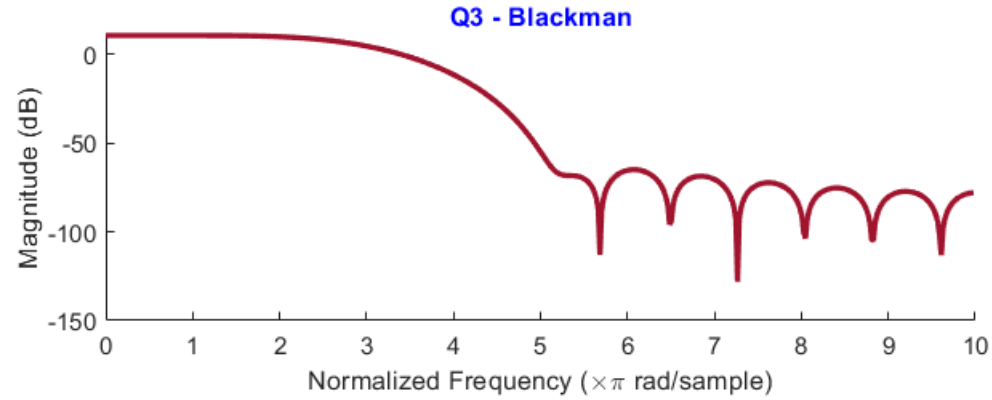
We draw the magnitude (in decibel) and phase response of the designed filters.

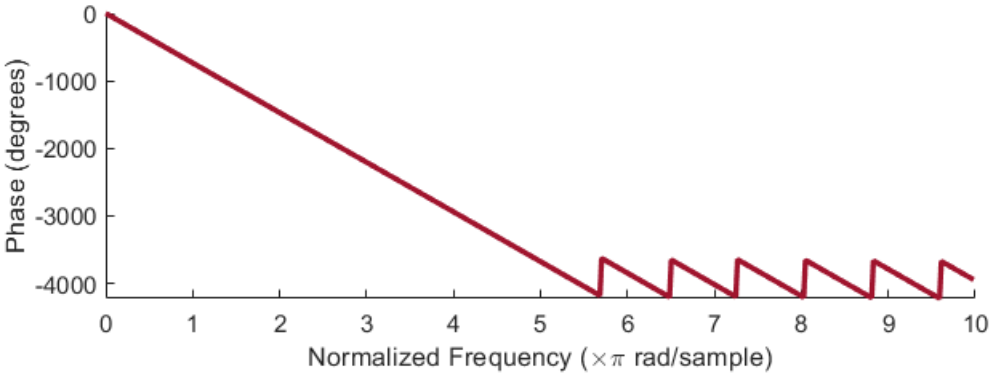

Q3 - Hanning
Magnitude (dB)
0
-50
-100
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)

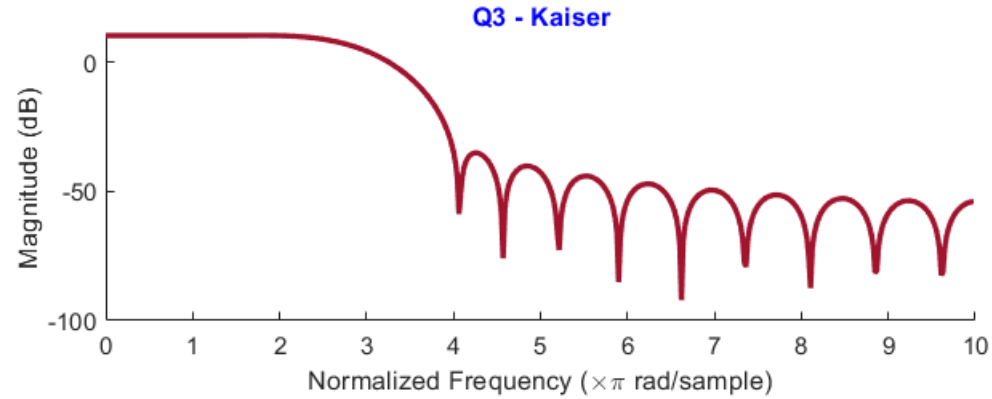

Phase (degrees)
0
-1000
-2000
-3000
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)

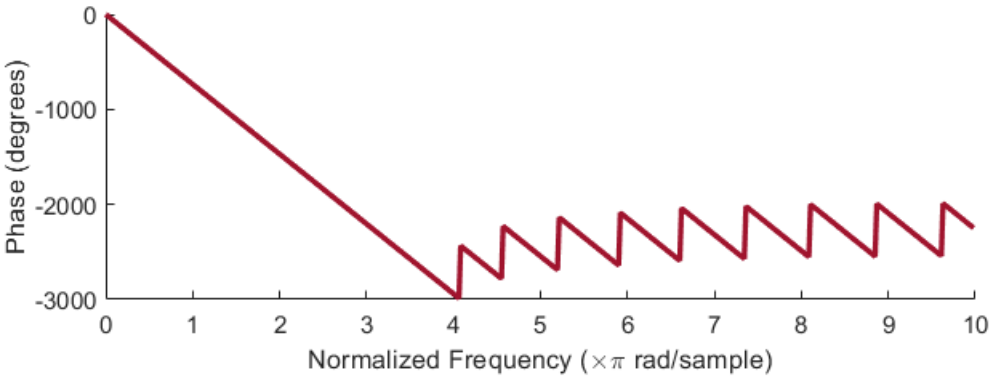

Q3 - Hamming
Magnitude (dB)
0
-50
-100
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)


Phase (degrees)
0
-1000
-2000
-3000
-4000
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)


Q3 - Blackman
Magnitude (dB)
0
-50
-100
-150
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)


Phase (degrees)
0
-1000
-2000
-3000
-4000
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)


Q3 - Kaiser
Magnitude (dB)
0
-50
-100
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)


Phase (degrees)
0
-1000
-2000
-3000
0 1 2 3 4 5 6 7 8 9 10
Normalized Frequency (×π rad/sample)