

EE 311
Hour Exam 2

Name _____
February 28, 2018

1. Explain why an odd ordered high pass FIR filter with linear phase must have an odd number of zeros at $z = +1$.

2. Suppose I have a low pass FIR filter with a zero at $-0.5 + 0.866j = 1 \angle 120^\circ$. If the sample frequency is 11025 Hz what frequency does this zero correspond to?

3. When designing a windowed filter a Blackman window produces a filter with a lower ripple number than any other window we have looked at. Why would we not use a Blackman window for everything?

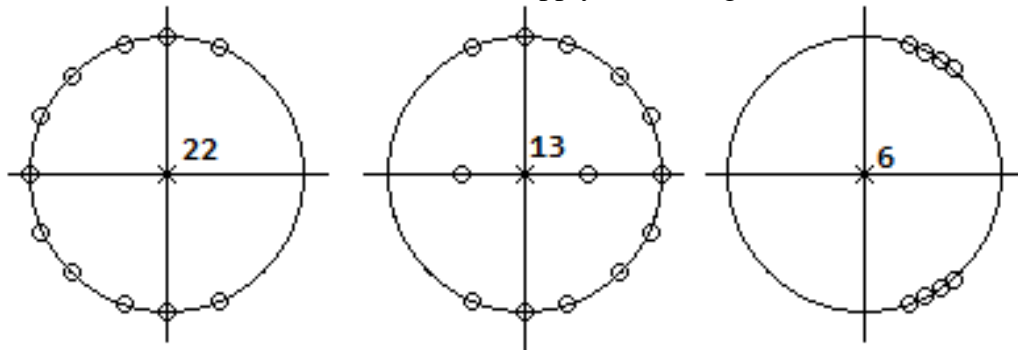
4. I want to design a low pass FIR filter with linear phase that meets the following specifications.

Sample frequency	44100 Hz
Pass band edge	1200 Hz
Pass band ripple	0.005
Stop band edge	2050 Hz
Stop band ripple	0.007

What is the minimum number of bits I need for the A/D and D/A converter?

5. If a window function for an FIR filter has a very broad main lobe in the frequency domain, what characteristics would you expect if it is applied to a filter (in terms of ripple and transition band width).

6. Draw a circle around those items below which apply to each figure



FIR
Stable
Causal
Linear Phase
Minimum Phase
LP HP BP BS

FIR
Stable
Causal
Linear Phase
Minimum Phase
LP HP BP BS

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7. Suppose I sample a 400 Hz sinusoid at 1000 Hz. Answer the following questions.

A) Explain how I could down sample the signal to a new sample rate of 500 Hz.

B) Since the new sample rate is less than twice the signal value of 400 Hz, what will be the frequency content of the newly down sampled signal?

8. Suppose you are given the transfer function for a windowed FIR filter which was designed using a Hamming window. (The original unwinded filter has been lost.) Outline in detail how you could redesign this filter using a Blackman window.

9. Given below are three FIR filters. Fill in the blanks to indicate whether each has *minimum* phase, *maximum* phase, or *mixed* phase.

A) $\frac{z^2 + 1.3z + 1.4}{z^3}$ _____

B) $\frac{z^2 + 1.4z - .3}{z^2}$ _____

C) $\frac{2z^2 - 3z + 1.7}{z^2}$ _____

10. Find the phase shift of the following system at 0 Hz. Show your work.

$$H(z) = 0.0456 \frac{(z - 1)(z^2 - 0.7z + 1)}{z^3}$$