ELEC3004/7312 Signals, Systems, and Control

Practice Class Quiz 2,

Note: Actual Quiz is 10 Questions Only

All Questions of Equal value

Time Allowed: 30 minutes

Answer On True/False Multiple Choice Answer Sheet

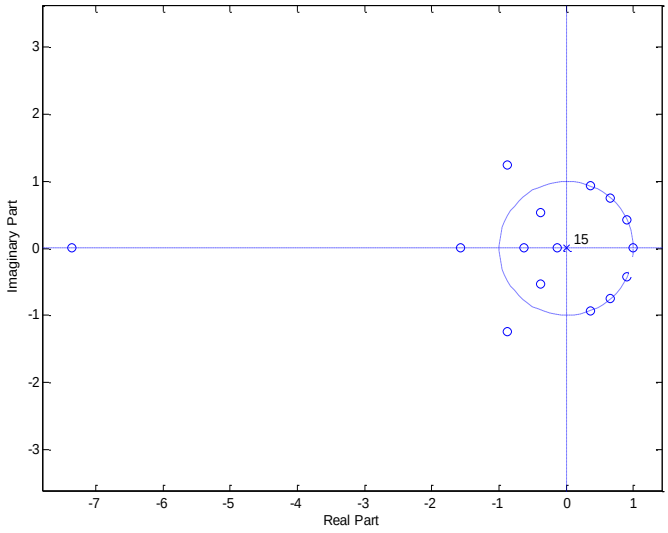

Figure 1 Pole-Zero plot for filter A

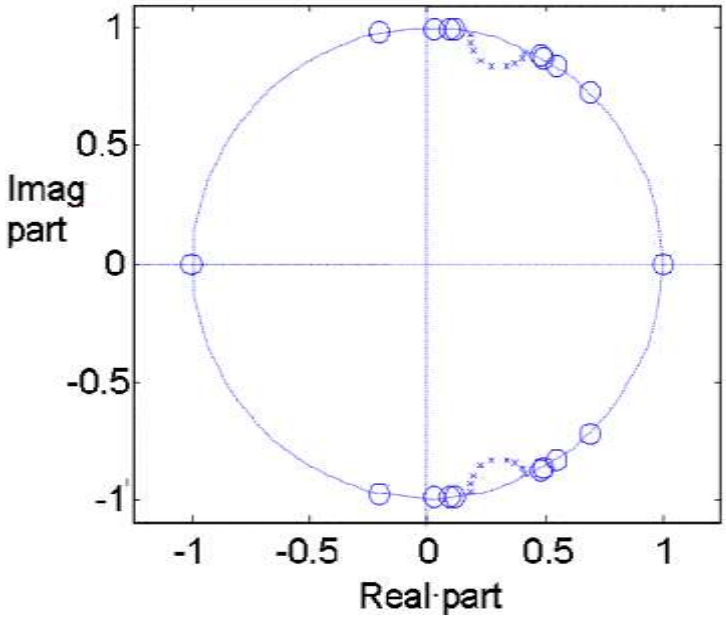

Figure 2 Pole-Zero plot for filter B

Note: if two or more answers seem to apply, always choose the most appropriate answer. Questions 1-7 relate to Figures 1 and 2 above.

1. Consider the pole-zero diagrams of filters A and B of Figures 1 and 2. Which of these filters is linear phase, if any?
   (a) Filter A
   (b) Filter B
   (c) Both Filter A and Filter B
   (d) Neither Filter A nor Filter B

2. Consider the pole-zero diagrams of filters A and B of Figures 1 and 2. Which of these filters is FIR, if any?
    (a) Filter A
    (b) Filter B
    (c) Both Filter A and Filter B
    (d) Neither Filter A nor Filter B

3. Consider the pole-zero diagram of filter A in Figure 1. What type of filter is this?
    (a) Low Pass
    (b) High Pass
    (c) Band Pass
    (d) Band Stop
    (e) None of the above

4. Consider the pole-zero diagram of filter B in Figure 2. What type of filter is this?
    (a) Low Pass
    (b) High Pass
    (c) Band Pass
    (d) Band Stop
    (e) None of the above

5. Consider the pole-zero diagram of filter B of Figure 2. How many times does the magnitude response go to zero in the stop band(s)? (Note: only consider the positive frequency halfband)
    (a) 0
    (b) 5
    (c) 10
    (d) 20
    (e) None of the above

6. Consider the pole-zero diagram of filter A of Figure 1. How many coefficients are needed to implement the filter?
    (a) 9
    (b) 10
    (c) 11
    (d) 12
    (e) None of the above

7. Consider the pole-zero diagram of the filter A of Figure 1. What is the order of this filter?
    (a) 9
    (b) 10
    (c) 11
    (d) 12
    (e) None of the above

8. Consider an odd order lowpass FIR filter designed by the Parks-McClelland Method. Which of the following statements is/are false?
   (i) The impulse response can be expressed as a polynomial in ω (angular frequency)
   (ii) The zeros off the unit circle and real axis occur in reciprocal conjugate quads
   (iii) There are no zeros on the real axis

   (a) (i) and (ii) only
   (b) (ii) and (iii) only
   (c) (i) and (iii) only
   (d) All of the above
   (e) None of the above

9. Which of the following statements is true for a filter with the following transfer function?

$$T(z) = \frac{1 - \alpha z}{z - \alpha}$$

   (a) The transfer function is linear phase
   (b) This is an IIR filter
   (c) This is an FIR filter
   (d) All of the above
   (e) None of the above

10. Which of the following statements, if any, is true for an IIR filter?
   (a) The impulse response of an IIR filter is generally either symmetric or anti-symmetric
   (b) IIR filters are suitable for multirate designs
   (c) IIR filters have low sensitivity to coefficient quantization
   (d) All of the above
   (e) None of the above

11. Which of the following statements, if any, is <u>false</u> for a zero phase low pass FIR filter with real impulse response h(n)?
   (i) The impulse response is symmetric (h(x)=h(-x))
   (ii) The impulse response can be expressed as a sum of cosine terms
   (iii) Odd order filters always have a zero located at z = -1.

   (a) Both (i) and (ii)
   (b) Both (ii) and (iii)
   (c) Both (i) and (iii)
   (d) All of (i), (ii), and (iii)
   (e) None of (i), (ii) and (iii)

Questions 12-14 relate to the following set of specifications for an FIR low pass filter.

Sampling Frequency = 48 kHz
Passband Edge = 900 Hz
Stopband Edge = 1100 Hz
Passband Ripple = 2 dB
Stopband Attenuation > 80 dB

12. What is the best estimate of the number of multiplications per second required to process these data with a standard transverse FIR filter (based on the harris formula for filter length)?
    (a) 900
    (b) 12 million
    (c) 32 million
    (d) 42 million
    (e) None of the above

13. What is the maximum downsampling factor, M, which could be applied to the output of this filter without significant aliasing distortion?
    (a) 4
    (b) 12
    (c) 24
    (d) 36
    (e) None of the above

14. What is the best estimate of the number of multiplications per second required to process this data with a polyphase downsampling filter?
    (a) 2.5 million
    (b) 1.8 million
    (c) 600,000
    (d) 200,000
    (e) None of the above

END OF QUIZ