EECS 360
Homework #14

1. Section 6.10 Participation Activities
   - 6.10.1: Transfer function and pole location vs. impulse response
   - 6.10.2: Stability and transfer function poles.
   - 6.10.3: Transfer function, poles, and stability.
2. Section 6.10 Challenge Activity
   - 6.10.1: BIBO stability of H(z)
3. Exercise 6.10.1
4. Given a difference equation y[n]=x[n]+2bcos(ϕ)y[n-1]-b^2y[n-2] transfer function H(z).
   a. Find the poles and zeros.
   b. Specify the conditions on the parameter b such that the system is BIBO stable
5. Section 6.11 Participation Activities
   - 6.11.1: Frequency response of a lowpass filter.
   - 6.11.2: Discrete-time system frequency response.
   - 6.11.3: Example: Input-Output Pair to Other Descriptions.
6. Section 6.11 Challenge Activity
   - 6.11.1: System frequency response.
7. Exercise 6.11.1
8. Exercise 6.11.2
9. Show $X(z) = 5 + 4z^{-1} + 3z^{-2} + 2z^{-3} + 1z^{-4} = \frac{5z^4+4z^3+3z^2+2z+1}{z^4}$
10. Section 6.12 Participation Activities
    - 6.12.1: Moving a zero along the unit circle.
    - 6.12.2: Effect of moving a zero toward the center of the unit circle.
    - 6.12.3: Moving conjugate poles towards the center of the unit circle.
    - 6.12.4: Conjugate pole angles vs. frequency response.
    - 6.12.5: Pole zero placement vs. frequency response.
    - 6.12.6: Lowpass filter poles, zeroes, transfer function.
    - 6.12.7: Highpass filter.
    - 6.12.8: Bandpass filters.
    - 6.12.9: Bandreject filters.
11. Exercise 6.12.1 (You can use any plotting tool including Transfer Function Analysis by Manipulation of Poles and Zeros)
12. Exercise 6.12.2 (You can use any plotting tool including Transfer Function Analysis by Manipulation of Poles and Zeros)
13. Section 6.13 Participation Activities
    - 6.13.1: 250Hz notch filter design.
    - 6.13.2: Discrete-time notch filters.
14. Given a system transfer function

$$H(z) = \frac{z^2}{(z - (.5 + j0.8))(z - (.5 - j0.8))}$$

    a. Draw the pole-zero diagram.
    b. Is this a stable system?
    c. An analog signal x(t)=cos(2π160t) is sampled at 1000 samples/sec to form x[n].
    Find the output y[n] with x[n] input to this filter.
    d. This a BPF, what is its center frequency.
    e. What is the discrete time implementation of this system?

f. Explore H(z) and check your answers above using:
Complex z-Plane Plot and Frequency Response for System with 2 Poles
Transfer Function Analysis by Manipulation of Poles and Zeros

15. An analog signal is $y(t) = x(t) + \cos(2\pi 160t)$, where the 160 Hz tone is an interference signal. The signal y(t) is sampled at 1000 samples/sec to generate y[n]. Design a discrete time system to filter out (reject) the 160 Hz interference signal in the sampled signal. Validate your design.