ECE 345: Linear Systems and Signals

Fall 2020

**Lab #3 Report**

Note: you can use the equation editor in MS Word or a tool such as LaTeXiT to generate formulas for questions which ask about formulas. Alternatively, you can write your derivation and put a photo into the box.

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| **Mini-Lab 1 (44 points)** |  | **Mini-Lab 2**  **(56 points)** |  |  | **TOTAL (100 points)** |
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Group members:

* A
* B
* C
* D

**Minilab 1: Z-transforms (44 points)**

1. (6 points) Give the expression of the transfer function of the system. Show your work.
2. (4 points) What are the poles and zeros of the system?
3. (4 points) Give values of and that make the system stable. Why do these values make the system stable?
4. (6 points) Give the plot the pole-zero diagram for the values of and that you chose in part (c). Be sure to add an x-axis label, y-axis label, and title to all your plots.
5. (6 points) Give the plot the frequency response for using the values of and that you found in part (c).
6. (10 points) Give values of and such that the system acts approximately like a lowpass filter and explain why. Give the plot the frequency response for using these new values of and .
7. (4 points) If x[n]=0 does y[n]=0? Explain your answer.
8. (4 points) What kind of filter do you get by setting and : highpass, lowpass, or bandpass? Explain your answer.

**Mini-lab 2: AM Radio (56 points)**

1. (6 points) Give the plot of . What is the energy of the track you extracted?
2. (6 points) Give the plot of . What is the energy of ?
3. (8 points) Give the plot of for both and . What is the difference between the plot of and ?
4. (6 points) Find in the form

Show your work.

1. (8 points) Give the plot for both and . Compared to your can you see evidence of the non-message parts of signal? Explain your answer.
2. (8 points) Give the plot the output of the lowpass filter for the low noise () and high noise () settings. How does it compare to the plot of and ?
3. (8 points) Give the plot the output of final signal for the low noise () and high noise () settings. Compare the sound of both version of (low noise and high noise).
4. (6 points) Using the formula derived in part (d), What parameters of the system have the most effect on the signal to noise ratio (SNR)? If you wanted to improve the quality of reception, what parameters can you control as the system designer? Explain.