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% Karis Mao, Jack Shapiro, Lillian Kagy, Trevor Swan
% ENGR 130 Module 5.1 Report
% Section E
% November 5, 2023
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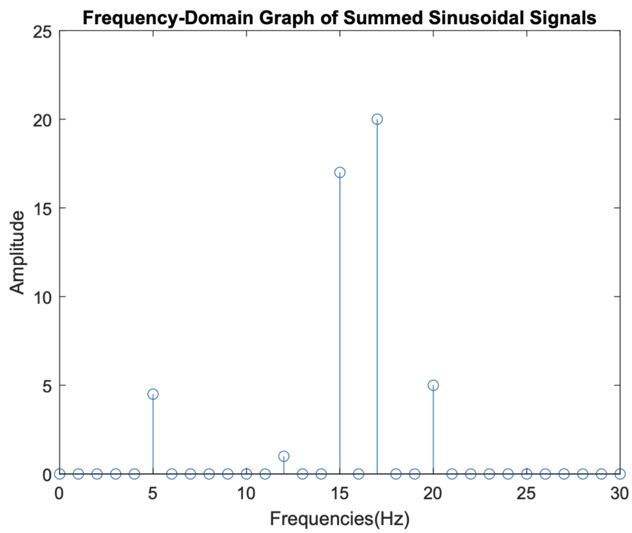
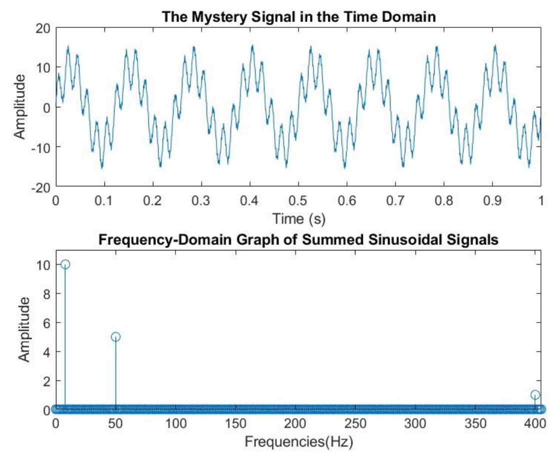
Lab 1

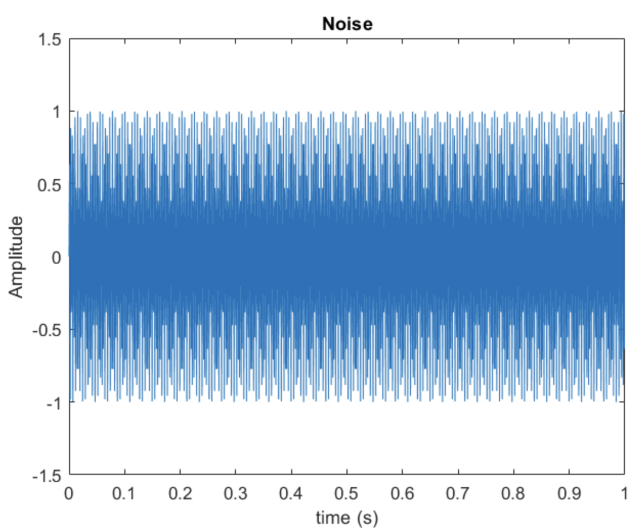
1. Include your plot from Part 3b.



2. Include your plot from Part 4d.



3. Include your plot from Part 4f.



4. Do the values in Table 1 and the values you found from the Fourier transform for y_comp agree? Why or why not?

We did find the values in Table 1 to match up with the values that we found on the Fourier transform for y_comp. Based on the table provided, there were 6 amplitudes that corresponded to 6 frequencies. We know our data was correct because there were 5 significant data points in our graph. The table had two different amplitudes for one frequency, so the getComposite function was able to add those two amplitudes together. This can be observed on our graph, as the peaks correspond to the sum of the amplitudes for each frequency.

5. Did you find all the mystery signal components? How can you tell?

We feel confident that we found all of the mystery signal components because the restored signal is completely uniform. There are no outliers in the data and all that is left is noise. If we failed to find all of the components in the data, then our noise would appear to have significant data still remaining. Also, we know that the given data was processed successfully, so it can be reasonably stated that this data would be processed successfully as well.

6. White, brown, and pink noise are oftentimes found in signals, especially audio signals. Research and describe each type. How would each kind of noise appear on y_comp's Fourier transform stem plot?

White noise is a steady constant hum like a ceiling fan and represents all noise audible to the human ear. We might expect this to be uniformly distributed after a Fourier Transformation. Pink noise also represents all noise available to hear by the human ear but the energy is not equally distributed. The energy is more intense at lower volumes which is why it is deeper than white noise. Because Pink noise is not equally distributed, we believe pink noise would appear to have many 'spikes' when put through a fourier transform. Brown noise is deeper than white noise and also has higher energy at lower frequencies similar to pink noise. We would expect our amplitudes outputted by the Fourier transform to be greater towards the left of the x-axis, which corresponds to lower frequencies. We would also expect a greater upper bound than white noise, which is similar to what may be observed with pink noise.

Engineering Design Process Sheet **Module 5**

Fill out this worksheet as you work through the design of your arrhythmia-detecting device. You will submit this typed and completed worksheet as part of your module report.

Part A: Define Problem
Write a description of the problem in your own words.

- Clinicians must be able to know when arrhythmias in patients occur to diagnose heart conditions. A device must be designed that would alert them and detect them of abnormal ECG patterns (arrhythmias).

Part B: Determine Specifications & Requirements
Ask at least two clarification questions.

1. Are we allowed to use multiple pieces of extra equipment to connect to the Arduino?

2. Does the 40 minutes to build the device prototype include the time to create the diagnosing code?

3. Are there any size constraints to the prototype?

Part C: Identify Design Decision Criteria
Thinking about what would be helpful for the intended user of your product, create a list of at least two criteria by which you will evaluate your design concepts. Indicate whether they are equally important or whether one should be weighted more heavily than the other. Explain why you chose these criteria.

1. Detects the arrhythmia and the type of arrhythmia it is

2. Alerts the clinician that there is abnormality

- Detecting the arrhythmia and altering the clinician are equally as important. The arrhythmia must be detected to satisfy the purpose of the device, and altering the clinician is important since if an arrhythmia is identified but not communicated to a professional, the detection was useless. However, identifying the type of arrhythmia is less important in the design, since the device would still serve its purpose without this feature.

Part D: Generate Design Concepts
List as many ideas as you can for designs and features.

- Device beeps to alert clinician, where the frequency of the beeps correlates to the type of arrhythmia that has been detected
- Device beeps and flashes red when an arrhythmia is detected
- The heart rate is immediately saved to a data file when arrhythmia is detected so it may be used for future discussion

	ENGR 130 Module Planning		Module	4	Section	E	Team	1	
			Scheduled		Actual				
#	Task	Deadline	Start	End	Start	End	Primary	Secondary	% Complete
	Complete and Submit Contract	11/1	10/31	10/31	10/31	10/31	Karis	All	100
	Type team's code for Lab 1, pt. 2	10/31	10/31	10/31	10/31	10/31	Trevor	Karis	100
	Analyze signal via Fourier transform	10/31	10/31	10/31	10/31	10/31	Trevor	Karis	100
	Type team's code for Lab 1, Pt. 4	11/2	11/2	11/2	11/2	11/2	Lily	Jack	100
	Discuss questions for Lab 1	11/2	11/2	11/2	11/2	11/2	All	n/a	100
	Type team's answers for Lab 1 questions	11/6	11/2	11/5	11/2	11/2	Jack	Trevor	100
	Type responses to Design WS	11/6	11/2	11/4	11/2	11/4	Karis	Trevor	100
	Assemble module report 5_1	11/6	11/4	11/4	11/4	11/5	Trevor	n/a	100
	Proofread module report 5_1	11/6	11/4	11/4	11/4	11/5	All	n/a	100
	Submit module report 5_1	11/6	11/5	11/5	11/5	11/5	Trevor	n/a	100
	Set up banana cables and CH3 for Lab 3	11/7	11/7	11/7			Jack	Lily	0
	Turn on Oscilloscope and calibrate probe	11/7	11/7	11/7			Lily	Jack	0
	Manipulate Oscilloscope and probe	11/7	11/7	11/7			Trevor	Karis	0
	Test the heartbeat sensor while its connected	11/7	11/7	11/7			Lily	Karis	0
	Freeze the Oscilloscope and save data	11/7	11/7	11/7			Trevor	Jack	0
	Write the code for Lab 3, pt 2 & 3	11/7	11/7	11/7			Karis	Trevor	0
	Complete Design Process WS through F	11/7	11/7	11/7			Jack	Trevor	0
	Discuss questions for Lab 3	11/7	11/7	11/7			All	n/a	0
	Type teams responses for Lab 3 Questions	11/12	11/7	11/12			Lily	Karis	0
	Contruct the prototype for the device	11/9	11/9	11/9			Jack	Trevor	0
	Construct the presentation slide for Lab 4	11/9	11/9	11/9			Karis	Lily	0
	Test the device using provided CSV Files	11/9	11/9	11/9			Karis	Jack	0
	Determine the type of arrhythmia with code	11/9	11/9	11/9			Jack	Trevor	0
	Modify Code to fit Design Features	11/9	11/9	11/9			Trevor	Karis	0
	Proofread Code and Presentation	11/9	11/9	11/9			Lily	Karis	0
	Present for the first half of the presentaion time	11/9	11/9	11/9			Trevor	Karis	0
	Present for the second half of the presentaion time	11/9	11/9	11/9			Jack	Lily	0
	Assemble module report 5_2	11/12	11/10	11/11			Karis	n/a	0
	Proofread module report 5_2	11/12	11/12	11/12			All	n/a	0
	Submit module report 5_2	11/13	11/12	11/12			Karis	n/a	0

Last Updated	
Trevor	11/5