Full Name: _____

EEL 3135 (Spring 2025) – Lab #00

Acknowledgement: The material in this and all forthcoming labs are in part based on the labs developed jointly by EEL3135 faculty and peer instructors and, in part, based on labs developed by the authors of the textbooks and the Peer Instructors in the past semesters.

Lab 00 Information:

- The material in this section is informational. Please read through the section as it helps you work on the lab exercises in the next section. There may be code examples in this informational section. You are welcome to copy-and-paste them to MATLAB to run the code, but no submission is needed on any test run.

Why Labs?: This course provides a theoretical and practical basis for the study of Signals & Systems. In the theoretical part of the course, you will be introduced to concepts ranging from complex numbers and Euler's formulas, to frequency-domain and complex-domain analysis of signals and the systems that process them. You'll be introduced to digital filtering, the sampling theorem, the Fourier series, and discrete and fast Fourier transforms.

As you'll see this week, the theoretical part of this course introduces concepts on a mathematical level. In the real world, you as a budding engineer will be asked to process real-world signals. To that end, the practical "lab" portion of this course aims to train you to apply your knowledge using the computational tools that are at your disposal. We ask you to apply your theoretical knowledge to solve problems; first computer-generated ones, then real-world ones. Labs exercises may include create sounds, arranging sounds to make music, observing aliasing, blur and de-blur images, removing noise from audio signals, and using the Fast Fourier Transform to find the heart rate from a real-world electrocardiogram. By the end of the semester, we hope that you'll understand the theory behind all of these things, and be able to apply them in the real world. These labs can be a lot of work, but can also be a lot of fun. Be sure to start early!

Why MATLAB?: These laboratory exercises will be done in the scientific analysis platform from Mathworks called MATLAB. While all the labs could be completed using other popular platforms, such as Python, we decide to teach you how to solve Signals & Systems problems using MATLAB, because MATLAB is a, if not the most, widely adopted scientific analysis partform in the industry.

All MATLAB versions within recent years starting from version R2017a will work for the labs. Some earlier versions may also work. MATLAB can be accessed for free through the ECE cluster `https://view.ece.ufl.edu` or UF Apps `https://apps.ufl.edu`. However, we recommend that you purchase the standalone student version and install on your own computer to use because the standalone version is more convenient, and in case access to the internet is not available.

Purchasing MATLAB: Mathworks offers student version of MATLAB that can be purchased at their website. There are different toolboxes that contain application specific optimized APIs for development. **In our case, the only toolbox needed is the Signal Processing Toolbox.** (This toolbox is already installed in the ECE cluster and UF Apps if you decide to use the free versions of MATLAB there.) There are 2 purchasing options:

- If you only want the Signal Processing Toolbox, the MATLAB core would cost 50 dollars and the Signal Processing Toolbox would cost 10 dollars, a total of 60 dollars.
- Mathworks offers the MATLAB core along with many available toolboxes for 100 dollars.
- We suggest the second option because MATLAB and other toolboxes may be used in other courses. It is more cost-effective to purchase them all now.

A Note on Lab Grading: By the time you finish this course, we expect you to have a beginner's working background knowledge for signal processing in the real world. Students that have completed this course have found the experience gained in it to be invaluable in their work as signal processing engineers for real-world companies. As such, our grading is oriented toward two goals:

- We look to see that you have completed your tasks.
- We want to train you to reach a systems-level objective using many small theoretical steps.

At the beginning of this course, we will ask you to follow specific steps en route to a solution. As the course goes on, we will expect you to come up with more and more of the intermediate steps by yourself. TAs will be present and available to assist you, but by the end of this course we want you to be comfortable breaking down real-world signal processing problems and solving them. To that end, in your submissions, we need to see what you did. We want to see that you got the correct result, and that you came up with and thought about the intermediate steps on the way to your result. Therefore, we require you to submit all your code with comments and results when answering the lab exercises. We will describe the MATLAB publishing tool that can help you to do so later.

Lab 00 Questions

- Your laboratory solutions should be submitted on Canvas as a single PDF. Use the skeleton code provide with the lab to answer each question.
- Use the provided skeleton code as the basis for your solutions (easier for you and the graders).

Question #1: Open the code "eel3135_lab00.m" from Canvas in the MATLAB editor window.

When you run the script, have your speakers on. This script takes a string (`my_name` variable) and translates it into music. It also plays this music and saves it as a .wav file. Note, this MATLAB code is a bit more complex than where we will start in the course, but we want to show you the type of systems we will be building in the course.

(a) Change the variable `my_name` into your name.

(b) Use MATLAB's publish feature to turn the code into a PDF.

(c) On Canvas, submit the published code PDF and submit the associated .wav music file (which is "your name".wav) that should be saved in the same directory as your script file.