Exam, Fall 2020

DSP Lab (ECE 4163 / ECE 6183)

1. You may use the course resources (lecture videos, demo programs, textbook, etc) and your own prior work for this course.

2. You may not get help from anyone. You may not ask anyone for assistance. Your submitted work must be 100% your own effort.

3. You can consult the web for information (e.g., Tkinter) but not for how to solve the problems below.

4. If in doubt, ask me (Ivan Selesnick) by email at selesi@nyu.edu

Question 1

Part A) Consider the demo program `play_randomly.py` in the folder 'demo 12B'. This program generates pulses at random times by running a second-order difference equation. Modify this program to have a graphical user interface (GUI). [Use Tkinter.] Using sliders, the user should be able to control the following:

1. The duration of the pulses
2. The frequency of the pulses

The GUI should have a 'quit' button. Your program should save the output to a wave file.

Prepare a brief (less than 30 seconds) video demonstrating your program. Submit, the program (.py file), the video file, and the wave file. Ensure that your submitted program files runs on its own (without additional files needed) so that we can run your file.

Part B) Identify and describe one artifact or low quality aspect of the audio produced by the program. Describe how you could fix, improve or reduce the artifact to improved the sound. (You do not need to do implement it, just describe in words.)

Question 2

Write an implementation of real-time convolution using the overlap-add algorithm. The convolution for each block should be performed using the FFT. Do not use any `conv` function directly. For the impulse response, use the file `impulse_response_8kHz.wav` accompanying this exam. The input signal should come from a microphone. The output signal should be played to the loudspeaker/headphone. Both the input signal and the output signal should be saved to wave files.

Prepare a brief (less than 30 seconds) video demonstrating your program. Submit, the program (.py file), the video file, and the input and output wave files. Ensure that your submitted program files runs on its own (without additional files needed) so that we can run your file.