GEORGIA INSTITUTE OF TECHNOLOGY

SCHOOL of ELECTRICAL and COMPUTER ENGINEERING

ECE 2026 – Fall 2015 **Quiz 3 (Clicker – 25 Minutes)** **Version #1**

October 30, 2015

Student Name: ______________________ GT ID #: _____________ Clicker ID: _____________

Instructions:

1. A calculator and one sheet of paper of letter size with hand-written notes are allowed;
2. Use your clicker to enter your answers and the test version (NOTE: You will enter **numerical answers** not multiple choice);
3. **Enter your answers on your test in the space provided** which is to be turned in at the end of test (as a **backup** in case your clicker malfunctions)

Grading out of 4 points (requires completed test):

0 correct => 1/4; 1 correct=>2/4; 2 correct=>3/4; 3 correct =>3.6/4; 4 correct => 4/4

Use Clicker to Enter Test Version #: This is Version #1

<u>FIR FILTERING:</u> Problems 1.1 and 1.2 use the information below (Note: * represents convolution)

Assume the impulse responses for two cascaded LTI systems ($h_1[n]$ and $h_2[n]$) are defined as:

$$h_1[n] = u[n-1] - u[n-5]; \;\; h_2[n] = \delta[n-3] * h_1[n];$$

The overall impulse response is defined as: $h[n] = h_1[n] * h_2[n]$. Answer the following questions

PROBLEM 1.1

Find the discrete-time location, n_{last}, of the **last non-zero** sample in $h[n]$ (i.e, $h[n] = 0$ for $n > n_{last}$)

$n_{last} =$ 11

PROBLEM 1.2

Find the maximum numeric value of the overall impulse response, $h[n]$, (i.e., find $\max(h[n]) \geq h[n]$, for all n)

$\max(h[n]) = 4$

<u>SAMPLING</u> (Problem 1.3 and Problem 1.4 are independent of each other)

PROBLEM 1.3

A sinusoid is generated and played by the following MATLAB code:

```
tt = -0.2 : (1/400) : 0.8;
xx = cos((pi/0.05)*tt);
soundsc(xx,fs);
```

`fs` = 3200

Find the value of `fs` such that the tone heard through the speaker is at 80 Hz.

PROBLEM 1.4

Assume the input to an ideal C-D converter is $x(t) = \cos\left(2\pi f_0 t + \frac{\pi}{4}\right)$. When the sampling frequency is set to 400 Hz, the resulting discrete signal is $x[n] = \cos\left(0.2\pi n - \frac{\pi}{4}\right)$. Find the value of f_0 over the range $800 < f_0 \leq 1200$ to make this a true statement.

$f_0 =$ 1160