TERM TEST

Instructor: B. Ross
Date: March 16, 2012

NAME (print): ________________________________

STUDENT NUMBER: ________________________________

A 3” by 5” card of hand-written (not photocopied or digitally reproduced) notes may be used. No other aids may be used.
Please answer all questions on the exam paper. Use the backs of pages if necessary. Keep written answers brief and to the point. Write neatly and legibly. Carefully read all questions!

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Question 1 [24] Multiple choice: select the best answer to each question

[+2 correct, 0 nothing, -0.5 wrong guess; one free wrong guess permitted without penalty]

1. CSound has over 1500 of these:
   a. UGens
   b. samples
   c. users
   d. events

2. Which is true about MIDI:
   a. serial networking interface
   b. music event protocol
   c. introduced in the early 1980’s
   d. all of the above

3. A characteristic of convolution is:
   a. a sample is twisted beyond recognition
   b. the frequencies resident in one sample determine those that will be played in a 2nd sample
   c. sub-harmonic frequencies are generated
   d. it uses a band-pass filter

4. This MIDI message can be used to send hardware-specific information:
   a. note off
   b. continuous controller
   c. SYSEX
   d. all notes off

5. Identify a typical use of an LFO:
   a. slowly alter frequency, to create a vibrato effect
   b. remove hiss and pops from a digitized recording
   c. interpolate between samples, to generate new frequencies
   d. add headroom to a recording

6. FM synthesis is characterized by:
   a. two sidebands, no source frequency
   b. two sidebands and source frequency
   c. lots of sidebands and source frequency
   d. no sidebands, source frequency is amplified
7. Which of the following is not a type of VST module:
   a. audio effect
   b. oscillator filter
   c. MIDI effect
   d. instrument

8. A synthesis technique that translates orbiting 3D positions into a 2D waveform:
   a. wave terrain synthesis
   b. frequency-modulation synthesis
   c. granular reverb synthesis
   d. subtractive synthesis

9. This technique has been found to generate musically-interesting random melodies:
   a. use white noise to generate random notes
   b. use brown noise to generate random waveforms
   c. use pink noise to generate random differences between notes
   d. use blue noise to generate random lyrics

10. ADSR is an acronym for:
    a. attack decay sustain release
    b. audio digital sample resonance
    c. amplitude degradation sonic resistance
    d. advance descent stop reverse

11. The STFT is used for:
    a. analysing the harmonic spectra during intervals of time
    b. applying DFT in a O(n log n) algorithm
    c. finding non-discrete harmonic frequencies
    d. stretching audio files to indefinite durations, without changing their pitch

12. Which quotation was used *ad nauseum* by the prof during the course:
    a. “Revenge is a dish best served cold." (Star Wars: Wrath of Khan)
    b. “I don’t understand how clock language works." (Snooki, Jersey Shore)
    c. "All music is important, Dick. It's the universal language. One of our best hopes for the eventual realization of the brotherhood of man." (Bat Man TV series)
    d. “With great power, comes great responsibility.” (Spider-Man)
Question 2 [15] Define each term. Include a brief discussion of each as well.

a) VST

b) audio sample

c) SCO file

d) decibel

e) brown noise
Question 3 [20]

a) [12] Draw a diagram showing the complete processing for sampling and playback of digital audio. Include a descriptive discussion of all the major steps in the diagram.
b) [4] Discuss the effect of sampling frequency and quantization (sample bit size) on digital sound quality.

c) [4] With respect to sampling frequency, define and discuss the importance of the Nyquist frequency.
Question 4 [21] Consider the discrete Fourier transformation formula:

\[ f(t) = \sum_{n=1}^{T/2} \left( a_n \cos \left( \frac{2\pi nt}{T} \right) + b_n \sin \left( \frac{2\pi nt}{T} \right) \right) + a_0 \]

\[ a_0 = \sum_{k=0}^{T-1} \frac{x[k]}{T} \]

\[ a_n = \left( \sum_{k=0}^{T-1} x[k] \cos \left( \frac{2\pi nk}{T} \right) \right) \cdot \left( \frac{2}{T} \right) \]

\[ b_n = \left( \sum_{k=0}^{T-1} x[k] \sin \left( \frac{2\pi nk}{T} \right) \right) \cdot \left( \frac{2}{T} \right) \]

a) [4] Define the following terms:

\( t \):

\( T \):

\( x[k] \):

\( b_n \):

b) [4] The Fourier theorem states that any periodic (non-space filling) wave can be made with the sum of sine waves of different frequencies. What characterizes the frequencies that we are using in such a sum?

c) [4] What is meant by a “phase shift”? Where is it in the above formula for \( f(t) \)?
d) [3] What is the essential difference between the DFT over the Fourier Series? What is the main advantage afforded by this difference? What is a possible disadvantage?

e) [4] What is the FFT? What does it do differently from the DFT, and how? What is its advantage?

d) [2] What is meant by “smearing” with respect to the DFT? Identify how it can happen.
Question 5 [20]


b) [8] Identify and discuss 4 parameters that can be defined to control aspects of granular synthesis.
Question 5 (cont)

c) [4] Why are grains usually reshaped by envelopes? Describe how one of these envelopes might be structured.

d) [4] Describe how granular synthesis might be used to perform time expansion of samples.