Music 3SI:
Introduction to Audio/Multimedia App. Programming

Week #1 - 4/7/2006
CCRMA, Department of Music
Stanford University

Course Overview

Music 3SI
• Programming
• Audio / multimedia
• Introductory course
• SI: Student-Initiated course
  ‣ P/NC only, 1 or 2 units

Staff
• Instructor: Woon Seung Yeo
  (officially: course leader)
  ‣ woony@ccrma.stanford.edu
  ‣ http://ccrma.stanford.edu/~woony
• Office hours: TBD (or by appointment)
• Faculty sponsor: Prof. Jonathan Berger

Why?
• From my personal experience:
  ‣ not familiar with C/C++ (I hate pointers!)
  ‣ want/need to develop my own audio app.
  ‣ don’t really know how/where to begin
  ‣ need some “jumpstart”!
• A “service” course for CCRMA
  ‣ homework / projects for many CCRMA courses

CCRMA/Music Courses
• 220c
• 120 / 250a: Pd extern, OSC
• 424: VST
• 420: Stk
• 220a / 320 / 421 / 422
For Whom?

- Rated E for everyone (hopefully...)
- Especially...
  - “Hello World” C/C++ programmers
  - musicians
  - multimedia artists
  - CCRMA students
- Tutorials, demos, & templates
  - width > depth

Samples (1)

```c
#include <stdio.h>
main()
{
    printf("This is a C program\n");
}
```

Samples (2)

```c
#include <iostream>
using namespace std;
int main ()
{
    cout << "Hello World!";
    return 0;
}
```

Samples (3)

```c
#include <iostream>
using namespace std;
int main ()
{
  int a,b,c;
  a=2;
  b=7;
  c = (a>b) ? a : b;
  cout << c;
  return 0;
}
```

Samples (4)

```c
#include <iostream>
using namespace std;
void increase (void* data, int size) {
    switch (size) {
    case sizeof(char) : (*((char*)data))++; break;
    case sizeof(int) : (*((int*)data))++; break;
    }
}
int main ()
{
  char a = 'x';
  int b = 1602;
  increase (&a,sizeof(a));
  increase (&b,sizeof(b));
  cout << a <<", " << b << endl;
  return 0;
}
```

Samples (5)

```c
#include "WaveLoop.h"
#include "FileWvOut.h"
int main()
{
    // Set the global sample rate before creating class instances.
    Stk::setSampleRate( 44100.0 );
    WaveLoop input;
    FileWvOut output;
    input.openFile( "rawwaves/sinewave.raw", true );
    output.openFile( "hellosine.wav", 1, FileWrite::FILE_WAV, Stk::STK_SINT16 );
    input.setFrequency( 440.0 );
    for ( int i=0; i<40000; i++ )
        output.tick( input.tick() );
    return 0;
}
```
OS & Computer

- Mac OS X / Linux
- CCRMA machines
  - Linux boxes
  - Mac minis
  - obtain CCRMA account TODAY!
- Your own computer
- No support for Windows
  - can be used, though...

Topics

- C / C++ basics
- Audio / sound
- Audio plug-ins
- GUI programming
- Visual / multimedia
- Network

Schedule

Week 1: Introduction
- Today!
- Course overview
- Demos

Week 2: Audio Prog. (1)
- C/C++ review
- Overview of audio APIs
  - Stk (StkX) / RtAudio
  - PortAudio, ALSA, OpenAL, CoreAudio
- Audio programming basics
- Assignment #1

Week 3: Audio Prog. (2)
- Stk instrument / effect classes
- Audio effect / DSP basics
- Fast Fourier Transform
  - FFTW
  - AltiVec
Week 4: Plug-ins

- Audio plug-in technologies
  - VST
  - LADSPA, Audio Unit
- VST SDK
- Pd (& Max/MSP) externals
  - flext
- Assignment #2

Week 5: GUI (1)

- Guest lecturer from Apple
- Cocoa API
- GUI design: Interface Builder
  - Stk and Cocoa

Week 6: GUI (2)

- Cocoa review
  - Stk and Cocoa
- Qt API
- Qt Designer

Week 7: Visuals

- GUI review
- Image processing basics
- Core Image (Core Graphics)
- OpenGL with Cocoa / Qt
- The GIMP (and plug-ins)
- Final project proposal

Week 8: Multimedia

- Review of audio/visual programming
- Possible mappings
  - sonification / visualization
- Examples
  - SonART
  - R.S.V.P.
  - iTunes plug-ins

Week 9: Network & etc.

- Audio streaming
  - InetWvIn / InetWvOut classes (Stk)
- Open Sound Control (OSC)
- Project help session
Week 10: Presentation

- 6/9/2006 (tentative)

Assignments, Project, & Grading

Assignments / Project

- Assignment #1
  - command-line audio application
- Assignment #2
  - GUI-based audio app., VST plug-in, or Pd extern
- F.P.: anything about audio/MM, including
  - audio processing application / plug-in / extern
  - sonification / visualization program
  - audio streaming / sound control over network

Grading / Credit

- P/NC only
  - no letter grade
  - no incomplete
- 1 or 2 units
- Music grad students: BE CAREFUL!
- Auditors are always welcome!

Related Courses

CCRMA/Music Courses

- 220c
- 120 / 250a: Pd extern, OSC
- 424: VST
- 420: Stk
- 220a / 320 / 421 / 422
CS

- CS106b
- CS107
- CS193e

Course Website

- http://ccrma.stanford.edu/courses/3SI/
- Stay tuned to announcements
- Weekly schedule & readings
- Links: lots of interesting stuffs
- Templates / examples

Examples

- Command-line audio applications
- GUI-based audio applications
- VST plug-in (compressor)
- Image / graphics applications
- Sonification / visualization
- Network (OSC)

Finally...

- Survey
- CCRMA account application form