

# UCSB MAT 240D / Fall 2015

## Homework 1: Panning

**Due Date**      **October 9, 2015**

### General Instructions:

- **DO NOT USE HEADPHONES WHILE DEVELOPING!**
- Each problem should be solved in a separate source file named "Problem\_X.cpp".
- Source files should be sent to **mat.240.dap** at gmail dot com in a single archive file.

### Task 1: Install CMake

CMake is a requirement to build both AlloSystem and Gamma.

### Task 2: Clone and Build Gamma

Clone Gamma and follow the build instructions which can be found [here](#). Build a few examples and review the associated source code.

To get the repo on your machine use the terminal to navigate to a destination folder and type:

```
git clone https://github.com/AlloSphere-Research-Group/Gamma.git Gamma
```

### Task 3: Clone and Build AlloSystem

Clone AlloSystem and follow the build instructions which can be found [here](#). Build a few examples and review the associated source code. It is recommended that you put the Gamma and AlloSystem source directories side by side (i.e. in the same parent directory)

To get the repo on your machine use the terminal to navigate to a destination folder and type:

```
git clone https://github.com/AlloSphere-Research-Group/AlloSystem.git  
AlloSystem
```

### Problem 1: White Noise (10%)

Generate white noise using Gamma. Use the starter code at the end of this document.

### Problem 2: Panned White Noise (10%)

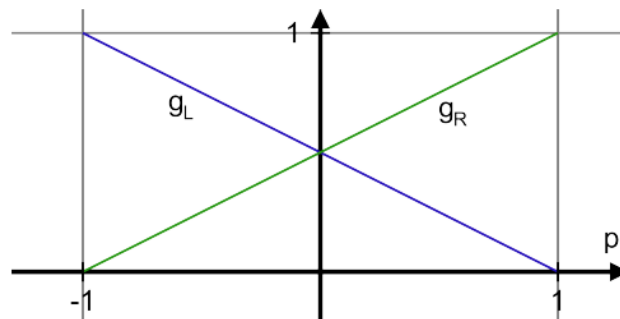
Use the Pan class (Two channel panner) in Gamma to pan the white noise from the previous problem from left to right at 1Hz.

Hint: Use an LFO class object to generate a triangle wave at 1 Hz.

### Problem 3: Linear Panning (35%)

Write a linear panning function and use it to pan a sine oscillator tuned to 440 Hz from left to right at 0.5 Hz.

The function should take a sample and a position. It should return the left and right channel samples. The position should be between -1.0 (far left) and 1.0 (far right).



Equations:

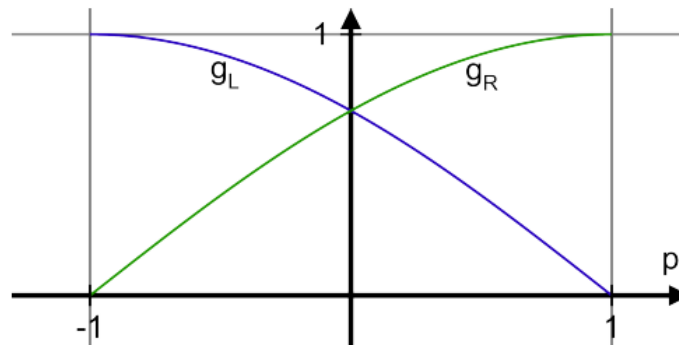
$$p' = \frac{p+1}{2} \quad (-1 \leq p \leq 1; p \text{ is the position})$$

$$g_L = 1 - p' \quad (\text{Left Channel Gain})$$

$$g_R = p' \quad (\text{Right Channel Gain})$$

### Problem 4: Equal Power Panning (20%)

Write an equal power panning function and use it to pan a sine oscillator tuned to 440 Hz from left to right at 0.5 Hz.



Equations:

$$p' = \frac{\pi}{2} \times \frac{p+1}{2}$$

$$g_L = \cos(p')$$

$$g_R = \sin(p')$$

### Problem 5: Stereo Panning (25%)

In the previous problems we worked with single channel sources (mono) and created a stereo image using panning. Design a scheme to perform stereo panning (stereo input to stereo output) and implement it. Discuss your scheme and write a test for it.

**Good Luck!**

## Gamma Starter Code:

```
#include <stdio.h>
#include "Gamma/AudioIO.h"
#include "Gamma/Domain.h"

using namespace gam;

int frameCount      = 512;
int samplingRate    = 44100;
int channels         = 2;

void audioCallBack(AudioIOData& io)
{
    // Your Code: Executes once every frameCount samples

    while(io())
    {
        // Your Code: Executes on every sample

        for (int i = 0; i < channels; i++)
        {
            io.out(i) = 0.0;
        }
    }
}

int main()
{
    AudioIO audioIO(frameCount, samplingRate, audioCallBack, NULL, channels);
    Sync::master().spu(audioIO.framesPerSecond());
    audioIO.start();
    printf("Press 'enter' to quit...\n");
    getchar();
    return 0;
}
```