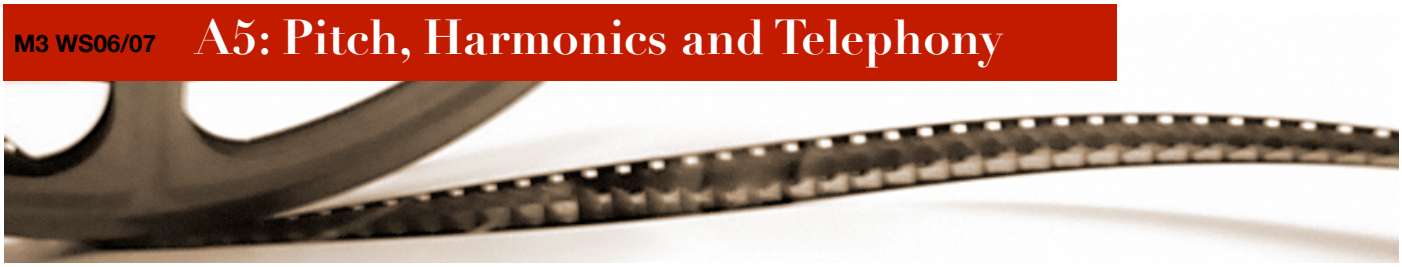
M3 WS06/07

A5: Pitch, Harmonics and Telephony



Introduction

In this assignment, we will continue to explore creating simple tones using digitally sampled audio. As you might have guessed, there is a clear relationship between frequency and the musical scale. Another place where you may have heard tones is in telephones, which use an audible encoding system called DTMF (dual-tone multi-frequency, commonly referred to as the touch tone) to send the numbers you dial across the telephone network.

Task

Using your project from the last assignment as a starting point, create a DTMF encoder that can output the DTMF tones for the digits 0-9, *, and #. Your program should be augmented to accept input from the user using a simple command-line interface (hint: use `printf()` and `scanf()`). It should offer a prompt that looks something like the following:

```
Please enter tone to play, or 'q' to quit: >
```

The user can then enter one of the digits 0 to 9, *, or #, and the DTMF tone for that digit should then be played for half a second. We recommend that you use the "push" model code from the last assignment as a starting point, as it is simpler. More information about DTMF encodings can be found on Wikipedia: http://en.wikipedia.org/wiki/DTMF

Answer the following question:

1. For two frequencies f_0 and f_1, what is the formula you used to compute the DTMF signal to be played by PortAudio at sample number i?
2. Each DTMF tone is comprised of two frequencies. Why are two frequencies used instead of just one?

Additional Credit

Credit above 2.0 will be awarded for one or more of the following:

- Augment your program to accept as input a string of DTMF tone digits. Your program should then play each tone in the string one at a time, with at least 200 milliseconds of silence in between.
- Write your program using the pull model instead of the push model.
- Augment your program so that the keys 'w' to 'i' plays the pitch corresponding to the musical notes 'c' to 'b'.

Submission

Submit a zip archive of your Xcode project to **eric@cs.rwth-aachen.de** by **Sunday, December 3, 2006 at 23:59**. The subject of your email should be "**M3 Assignment 5**"; be sure to use this **exact** subject line as it will be used to filter assignment submissions for grading. Remove the "build" folder in your project before submitting. You should also include a README file (plain text or pdf) that includes the names of you and your group member(s), a brief summary of what you accomplished, and answers to the above questions.