

Homework 2, I400: Due Jan. 25

For each problem submit the R code you created along with your answers. Please submit your homework on time. Late homework will lose partial credit.

1. Working from the `simple_sine.r` R program, create and listen to sine and cosine waves at 440 Hz and -440 Hz (`sin()` and `cos()` in R). Plot the first several oscillations of each one (you don't need to submit the plots). Describe the similarities and differences between the sounds and explain why you hear what you do.
2. The `*` operation in R is pointwise multiplication between vectors (of the same length) so that `(1:10)*(1:10)` produces the first 10 squares: 1,4,9, ... 100. Use this operation to create a sine wave at 1000 Hz that gradually emerges from silence and increases to its maximum amplitude.
3. The `runif(1)` command produces a random number between 0 and 1. Modify the `equal_temperament_test.r` program to choose randomly between generating an equal tempered 4th and a 4:3 4th. Your program should print out the correct answer at the end, but you should try to identify which 4th it is simply by listening. Perform this experiment 10 times and report the number that you identified correctly. Do the analogous experiment with a major third (5:4 vs. $2^{4/12}$). It may help to use the R syntax:

```
if (runif(1) > .5) { R commands here ... } else { R commands here ... }
```

4. Working from the `intervals.r` program, create a "chromatic" scale of 11 evenly spaced (in the sense of equal temperament) notes. That is, if you begin with the 0th note, the 11th note should be the octave above the 0th note. Listen to the scale using R. Comment on what you believe to be the musical feasibility of this scale, justifying your answer.