Physics of Music
Physics 341
Assignment 1

1) In my backyard, an apple hangs on a branch. The wind causes the apple on the branch to oscillate up and down. A small squirrel runs onto the branch. What happens to the frequency of oscillation? The squirrel eats part of the apple while sitting still on the branch. What happens to the frequency of oscillation? The the remains of the apple fall to the ground. What happens to the frequency of oscillation? The monkey now nibbles part way through the the branch behind itself thinning the branch (closer to the tree). What happens to the frequency? It finally runs off the branch. Same question.

2) A car's dampers (shock absorbers) are shot, so the car oscillates up and down on its springs a lot. Four of my friends jump into the car. What happens to the oscillation? We are joyriding and finally manage to flip the car. The wheels now oscillate on those springs. What is the relation between the frequency of the wheels' oscillation and that of the car previously?

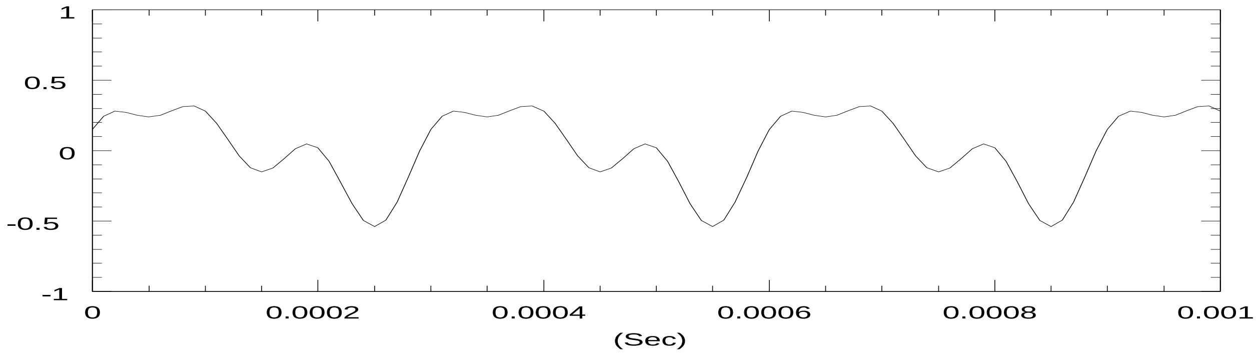
3) A heavy aluminium lid of some cooking pots makes a wonderful bell. While taking a bath I like to play with the lid– hitting it and dipping it sideways into the bath water. What happens to the pitch of the note as I dip it into the water and why? What happens to the damping and why? (You should try it. It is a great sound.)

4) The Q of a note of 400 Hz is 100 while that of a 4000 Hz vibration is 400. Which rings for a longer time? What are the times in each case for the amplitude to drop to 1/4 of its original value? (Remember what the definition of Q is.)

5) As you empty a wine bottle, the tone you get when you blow across it changes. How does it change and why? (Note assume that the tone you get while blowing is the same as you would get by "popping" the top of the bottle. While true, the reason will only come up later in the course).

6)A note has a frequency of 400Hz. What is its period? Another vibration has a period of 30ms (1ms= 1/1000 sec). What is its frequency?

7) In the following figure, what is the period, the frequency and the amplitude of the signal?



[Brief table of commonly used prefixes: n = nano = 10^{-9} = 1/1,000,000,000
μ = micro = 10^{-6} = 1/1,000,000
m = milli = 10^{-3} = 1/1,000
c = centi = 10^{-2} = 1/100
d = deci = 10^{-1} = 1/10
h = hecta= 10^{2} = 100
K = kilo = 10^{3} = 1000
M = Mega = 10^{6} = 1,000,000
G = giga = 10^{9} = 1,000,000,000]

It is interesting that in scientific notation, names are given only up to Y= Yotta= 10^{24}, whereas in classical Japanese there are names for numbers at least all the way up to 10^{52}.

http://en.wikipedia.org/wiki/Japanese_numerals.

(The Japanese use 10000=10^4 as the multiple for names, rather than our 1000.) Why in the 16th century anyone would need to give such a large number a name I do not know. This aside is of course totally irrelevant to the course.