1. [20 points] In no more than a few sentences of your own words, describe the inner ear's anatomy and function.

2. [20 points] An approximate conversion from Hz to Mel is 2595*log10(1+Hz/700). Plot the relationship between Mel and Hz from 20 Hz to 10000 Hz. Use a log axis for Hz (matplotlib's x_scale() function). Remember, as always, to provide a caption for your figure. Include your code in addition to your plot.
3. [20 points] Explain what is meant by "place of articulation." Provide examples of two consonants with different places of articulation that have the same manner of articulation. Describe the differences in production.

For the questions 4 and 5, record yourself saying "apple" /æ p ə l / at 16 kHz using wavesurfer (http://sourceforge.net/projects/wavesurfer/).

4. [20 points] Zoom in on the center part of the /æ/ time series (not spectrogram) to the point that you can see individual cycles. Showing your work, calculate your F0 in Hz (cycles/s). You will obtain a more accurate estimate if you use several cycles of your vocal folds opening and closing (be sure to divide by the number of cycles).
5. [20 points] Estimate the formants of the center part of /æ/ in your apple using wavesurfer's formant tracker (right click, Create pane, formant plot). Examine the spectrogram/spectrum and tracks to verify that wavesurfer did a good job of estimating the formants. Note that formants are frequently seen more clearly with a wideband spectrogram which wavesurfer will create for the formant plot. (Turn in a screen shot showing the formants.) You can read wavesurfer's estimate of F0 and the formants by looking at the status bar when the cursor is in the formant plot window.