Linguistics 104
Keating

Mid-term Quiz
February 8, 2018

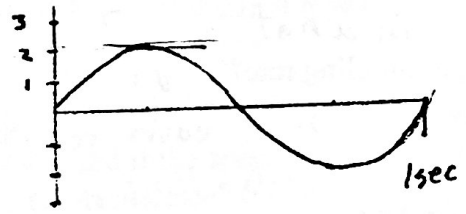
[total points = 40]

~You do not need to write full-sentence answers to these questions~

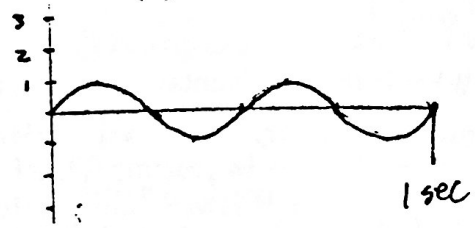
5.5

1. Given these two soundwaves (a) and (b), drawn to the same scale:

(a)



(b)



i. (1 point) Which has the higher amplitude?

a ✓

ii. (1 point) Does amplitude primarily affect the perception of pitch, or of loudness?

loudness ✓

iii. (1 point) Which has the higher frequency?

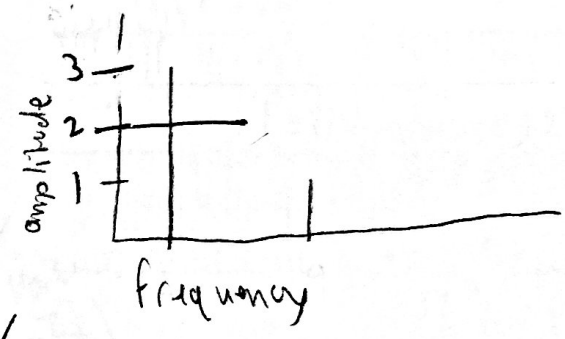
b ✓

iv. (1 point) Does frequency primarily affect the perception of pitch, or of loudness?

pitch ✓

1.5

v. (3 points) Draw the line spectrum that would result if these two waves were combined:



2 lines: 1 w/ labels

line a: —

line b: .5

frequencies are 1 and 2 Hz (evenly spaced) - need val

2

2. (2 points) If the f0 of a waveform is 130 Hz, what are the frequencies of the next 2 harmonics above the f0?

✓ 260 Hz, 390 Hz

If a sound has 2 adjacent harmonics at 750 Hz and 1000 Hz, what is the fundamental frequency?

✓ 250 Hz

7.5/9

3. (1 point) If I say a vowel [i] while gliding the pitch of my voice from low to high, what frequencies change – the harmonic frequencies, or the formant frequencies?

✓ harmonic frequencies

4. Two questions about digitized audio:

.5 **i. (1 point)** What is one advantage of a relatively high sampling rate for audio recordings? (Don't just say it's better, or more like the original – say *how* it is better/more like.)

high sampling rate = more individual samples means more individual points for the program to map the sound at, which thus gives you a more accurate pict of what the wave looks like in what way?

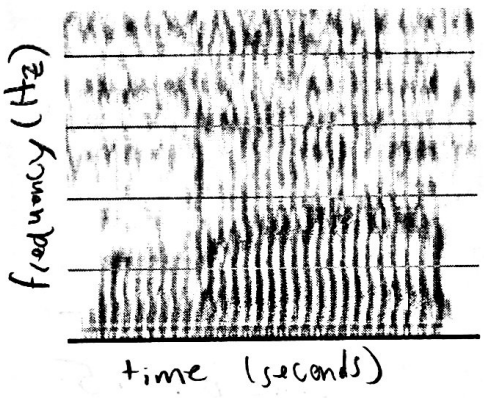
ii. (1 point) What is the disadvantage of a relatively high sampling rate?

✓ Higher sampling rate means more samples. Since each sample accounts for X number of bits, more samples means more bits. More bits means more memory needed to store the information on the computer

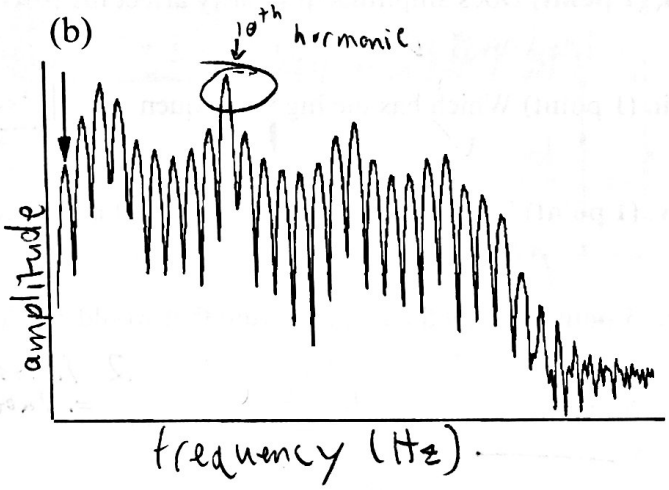
5. Acoustic displays:

✓ **i. (4 points)** Label the horizontal and vertical axes of these two displays:

(a)



(b)



✓ **ii. (2 points)** What is the name of each kind of display?

a = spectrogram

b = spectrum

✓ **iii. (1 point)** Which of these shows the harmonics of the voice? Circle any one harmonic in that graph.

b

9.5/10

6. (1 point) The vocal tract as a filter changes what <u>property</u> of the harmonics in the source?

the amplitude, or loudness ✓

7. (1 point) If two vowels have the same <u>height</u>, which formant will have a similar frequency?

first formant ✓

8. Formants of the uniform tube

i. (1 point) If a vocal tract is 16 cm long, and a uniform tube closed at one end, what is the *wavelength* (in cm) of the first (lowest) quarter-wavelength resonance (the first formant)?

$\lambda = 4 \cdot 16 = 64$ cm ✓

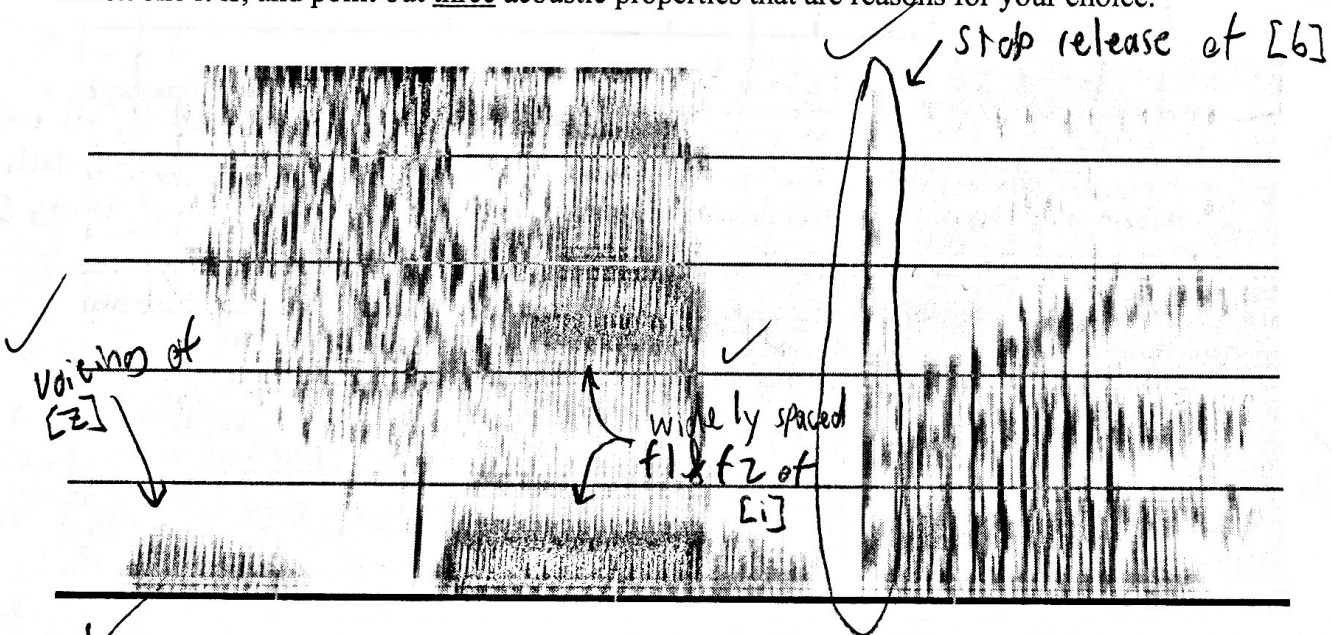
ii. (2 points) And if the speed of sound in air were 35,200 cm/sec, what would be the <u>frequency</u> (in Hz) of that resonance? (Give the formula, as well as your answer.)

$f = \frac{c}{\lambda} = \frac{35{,}200}{64} = 550$ Hz ✓ ✓

iii. (2 points) And what would be the second and third formant frequencies (in Hz)?

$f1 = 550$ Hz $f2 = 3 \cdot f1 = 1650$ Hz $f3 = 5 \cdot f1 = 2750$ ✓ ✓

9. (4 points) The spectrogram below shows one of these two words: **silver** OR **zebra**. Say which one it is, and point out <u>three</u> acoustic properties that are reasons for your choice.



"Zebra" - because the first fricative has a voicing bar, so it must be [z] & not [s]. The first vowel has an f1 right on top of the f0 and an f2 above 2000Hz, indicating a very high, front vowel [i], and not the less high, less front [ɪ]. after the first vowel is a voiced stop, as indicated by the voicing bar followed by the solid line

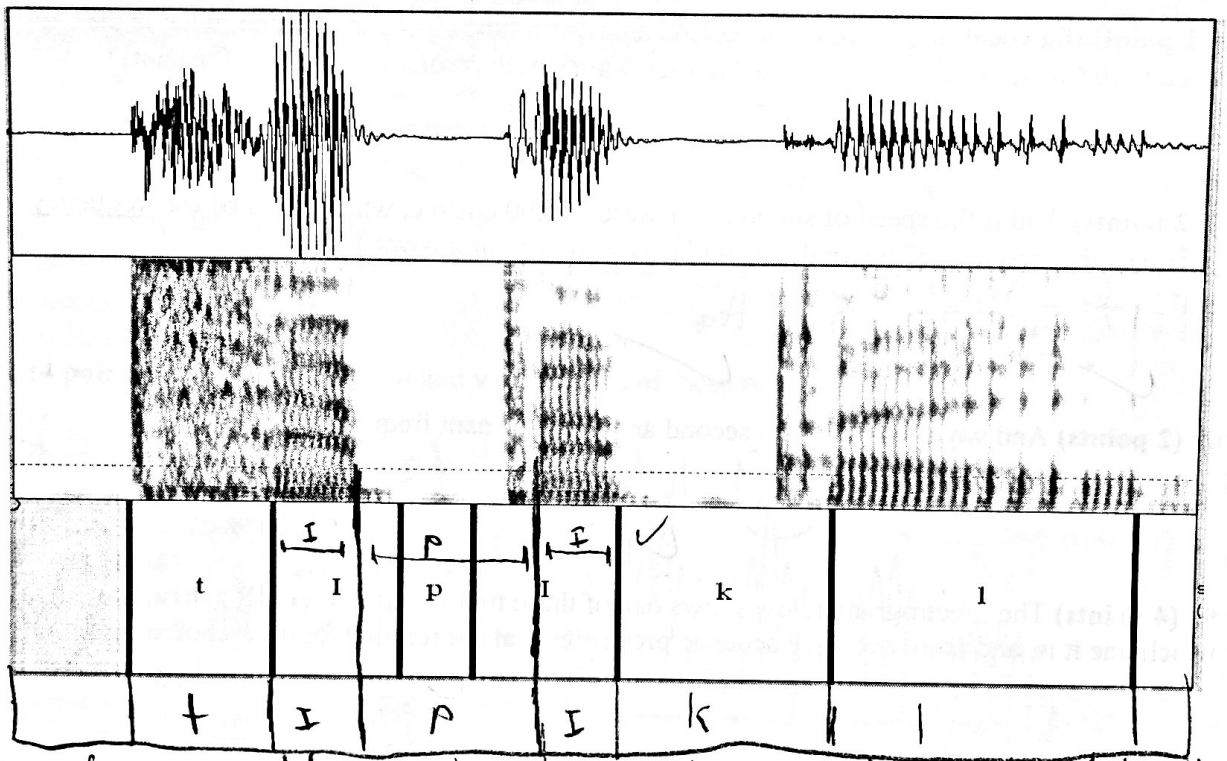
11

indicating the release of the stop [b]. No transient release "burst" would show if the sound were ~~[t] (or [tʃ])~~ /v/

3 **10. (3 points)** Name the three sources that are always present in the affricate [dʒ].

voicing, transient, frication

4 **11. (4 points)** In this display of the word "typical", the phonemes' labels are OK, but one phoneme is badly segmented (and so its 2 neighboring segments are wrong, too). Show where the segment boundaries should be, and say why (what criteria should be used).



The first [I] should stop right when the closure is made, as indicated by all energy disappearing except for some leftover voicing. This marks the beginning of the stop [p], which lasts all the way through the aspiration until the moment when the voicing of the following [I] begins, as indicated by the regular periodic striations appearing.

3 **12. (3 points)** Children generally have higher fundamental frequencies than adults. Why? They also generally have higher formant frequencies. Why? Is it necessarily the case that these two acoustic properties pattern together?

Children have smaller vocal folds, which thus vibrate faster, creating higher frequencies than larger adults. Their heads, and thus their vocal tract, is physically smaller/shorter than that of an adult so their vocal tract resonates a shorter wavelength, which thus equates to a higher frequency. This means that a child's vocal tract will amplify higher frequencies than that of a larger adult. While it is not technically a necessity that an individual that has small vocal folds must have a short vocal tract, in the real world, one would expect these two features to go hand in hand. If an individual is small (like a child) one would expect them to have both a short vocal tract & small vocal folds.

/10 7.5 + 9.5 + 11 + 10 = 38/40 great