

9.35 Spring 2024 – practice questions for Midterm 1

Most of these questions are shorter than what we will feature on the midterm, but cover the topics that will be on the midterm. The questions on the midterm will mostly be in the style of the first question provided below.

Expect 10-12 of these questions on the exam, of which you will have to choose a subset to answer.

Discuss the role of phase locking in coding sound frequency.

-what is the phenomenon of phase locking and what part of the auditory system exhibits it?

-what biological factor limits the information that is available from phase locking?

-what is one piece of perceptual evidence for the possible importance of phase locking as a code for sound frequency?

-what is one reason to doubt the idea that phase locking is used to estimate sound frequency?

If a pure tone has a period of 5 ms, what is its frequency in Hz? Please show your work.

If the amplitude (average pressure variation) of one sound is 10,000 times the amplitude of another, by how many decibels is it higher? Please show your work.

Draw a schematic spectrogram of a pure tone, and another one of a complex tone, and another one of a click. Label the axes.

What causes faint sounds to be emitted from the ears of many people? What are they called?

Suppose we conduct an experiment in which the detection threshold of a pure tone in *low-pass* filtered noise is measured as the cutoff of the noise (*the highest frequency it contains*) is varied. Assuming the power spectrum model of masking, draw a graph that shows the expected qualitative dependence of the tone's detection threshold on the noise cutoff. Explain the reasoning behind your answer in one sentence.

Briefly explain impedance matching. Why is it necessary, and what parts of the ear mediate it?

Give an example of an ill-posed perceptual problem and explain why it is ill-posed.

Give an example of an unconscious inference in perception.

What is the speed of sound at room temperature?

If the amplitude of a sound goes up by a factor of 10, by how many decibels does its level increase? If the power of a sound goes up by a factor of 10, by how many decibels does its level increase? Show your work.

What is the range of audible frequencies for a human with perfect hearing?

What is the period of a 100 Hz sinusoid? Show your work.

What are the ossicles, and what are two of their functions? How is the Eustachian tub important to one of these functions?

Given the traveling wave that occurs on the basilar membrane, what frequencies might you be quickest to detect, high or low?

Describe one nonlinear property of the cochlea and/or auditory nerve.

How does frequency tuning in the ear change with sound level?

Musical interval perception becomes much less accurate above ~4kHz. What is one explanation for why this might be?

How do the functions of inner and outer hair cells differ?

What are otoacoustic emissions and what is believed to cause them?

How many inner hair cells, outer hair cells, and auditory nerve fibers are there per ear in a human?

What is beating, and how is its perception constrained by the frequency selectivity of the ear?

Draw a graph showing the response of the cochlea at the place with a CF of 12 kHz to a 12 kHz tone, as a function of the level of the tone. On the same axes, draw a graph of the response if all outer hair cells were dead.

How is loudness perception affected by the loss of compression that occurs when people lose outer hair cell function?

What is one advantage of the notched noise method over Fletcher's band widening method for measuring frequency selectivity?

Do cochlear filter bandwidths increase, stay the same, or decrease with center frequency in absolute terms (i.e., when plotted on a linear frequency scale)? Do they increase, stay the same, or decrease when plotted on a logarithmic frequency scale?

Name one difference in frequency selectivity between humans and non-human animals.

What is the difference between a conduction loss and a sensorineural loss?

What is presbycusis? What is one piece of evidence for what might cause it?

Name one piece of evidence that traumatic noise exposure causes hearing loss.

Name one piece of evidence that hearing loss can in some cases be “hidden”, with apparently normal detection thresholds.

Describe the basic idea behind a cochlear implant in two sentences.

What is beating, and how is its perception constrained by the frequency selectivity of the ear?

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