Psychoacoustics

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Module 3b Homework (Hearing B – Selectivity and Nonlinearities)

Student Name: _____

1) (*5pts*) **The Bark Frequency Scale uses _____ frequency bands, corresponding to an equivalent number of critical bands in the basilar membrane.**

2) (*5pts*) **If the bandwidth of a narrow-band noise (< one critical bandwidth) increases so that it excites more than one critical band on the basilar membrane, while the overall intensity level remains the same, the loudness of the noise**

    a. decreases.
    b. increases.
    c. stays the same.
    d. fluctuates.

3) (*5pts*) **A neuron's threshold is defined as**
    a. the maximum stimulus level a neuron can respond to before collapsing.
    b. the minimum stimulus level that will cause an increase in the neuron's firing rate above the spontaneous discharge rate.
    c. the minimum stimulus level that will cause movement in the basilar membrane.
    d. 1000 ms.

4) (*5pts*) **The spontaneous activity of a neuron is defined as**

    a. the activity in a single neuron that occurs when a transient or impulsive stimulus is presented.

    b. activity in a single neuron when an adjacent neuron is stimulated.

    c. the activity in a single neuron that occurs without any stimulus.

    d. the activity in a single neuron when spontaneous signals are present

5) (*5pts*) **In what way are inner and outer hair cells in the inner ear innervated (connected to) differently to the nerve fibers?**

    a. Inner hair cells and outer hair cells both connect similarly to the nerve fibers.

    b. 10 inner hair cells connect to a single nerve fiber, whereas a single outer hair connects to a single nerve fiber.

    c. 10 outer hair cells connect to a single nerve fiber, whereas a single inner hair connects to a single nerve fiber.

    d. A single inner hair cell may be connected to up-to 20 nerve fibers, whereas about 10 outer hair cells are connected to each nerve fiber.

6) (*5pts*) **Weber's law (Weber's fraction) states that**

    a. the smallest amount of stimulus change that can be detected is proportional to the absolute magnitude of the stimulus.

    b. the amount of change in a stimulus is constant, dependent only on the subject.

    c. the perceived change in loudness is constant throughout all frequencies and does not depend on the base frequency.

    d. Sones = Loudness/JND.

7) (*15pts*) **Describe and explain the phenomenon of simultaneous masking. Use a graph to illustrate your explanation.**

8) (*15pts*) **Define forward masking. Use a graph to illustrate the phenomenon and give an example of a possible explanation as to why it occurs.**

9) (*10pts*) **Define backward masking. Use a graph to illustrate the phenomenon and give an example of a possible explanation as to why it occurs.**

10) (*15pts*) **Discuss the fact that the basilar membrane's response is non-linear** (*7 possible non-linear characteristics could be listed/described*)

11) (*15pts*) **Name and explain the two main processes discussed by which the frequency of auditory signals may be encoded or represented in the auditory nerve fibers. (Be specific; draw graphs and diagrams if they will help explain the processes involved.)**