EECS 225d: Midterm 1, March 6, 1995

Name:

For multiple choice and true/false questions, also write a brief (1-2 sentence) explanation of why the answer is correct. The parenthesized numbers after each question number give the relative point value of each question.

1. (2) The lowest (frequency) mode of an acoustic tube open at both ends is

   a) higher than

   b) equal to

   c) lower than

   the lowest node of an acoustic tube open at one and closed at the other end.

2. (2) The impedance of an acoustic tube

   a) increases

   b) stays the same

   c) decreases

   as the mass density ρ decreases.

3. (2) If the tension of a vibrating string is increased, the vibration frequency

   a) goes up

   b) stays the same

   c) goes down

4. (2) If the mass density in a uniform acoustic tube decreases, its resonant frequencies

   a) go up

   b) stay the same

   c) go down

5. (2) The spectrum of a trumpet note typically

   a) widens

   b) narrows

   c) stays the same

   as the excitation intensity increases.

6. (2) Most of the sound energy of a piano comes from the radiation pattern of the struck string (true or false)

7. (8) Describe the sequence of events leading to auditory nerve spikes when an acoustic pressure wave appears at the outer ear.

8. (2) The bundle of neurons leaving the inner ear contain most of the neurons in the brain's auditory system (true or false)

9. (2) The Voder was

   a) a physical model of the human vocal apparatus

   b) an early example of subtractive synthesis

   c) an early example of additive synthesis

   d) a member of the electorate with a head cold

10. (4) During World War II, Roosevelt and Churchill conversed by telephone between London and Washington, using a Vocoder. Explain why the vocoder was an important component of the communications link.

11. (6) The human vocal tract has been represented as a time variable filter excited by one or more sources. Discuss the excitation mechanisms for the production of vowels, voiceless fricatives (e.g., s, sh, f, th), and the voiceless plosives (p, t, and k).

12. (2) What is a phoneme? (A description of its characteristics or function will be acceptable in lieu of a strict definition).

13. (2) Speech recognition research in the 1950's primarily focused on

    a) the alphabet

    b) isolated digits

    c) toy dogs

    d) continuous speech

    (Mention an example).

14. (2) Roughly what is the wavelength of a 1 kHz sound wave travelling in air at room temperature?

15. (6) List two different mechanisms for a human listener to locate a sound source laterally in space (that is, to the left or right). Answer from the functional or engineering perspective (that is, don't worry about the physiology per se). What portion of the acoustic signal is used primarily by each mechanism?

16. (2) Having a long (> 2 sec) reverberation time for a room is typically

    a) good for
    b) bad for
    c) irrelevant for

    the intelligibility of speech.

17. (2) LPC and DTW were

    a) Major developments in speech technology in the 60's and 70's
    b) Major developments in speech technology in the 80's
    c) The initials of two commentators on ABC's Wide World of Sports

    (Expand the acronyms).

18. (5) Associate 5 of these names (you can skip one) with developments in science or engineering.

    - Dudley
    - Helmholtz
    - von Kempelen
    - Wheatstone
    - von Bekesy
    - Kiang

19. (5) Choose an engineering application in speech, music, or general audio, and explain how in principle the study of some aspect of human performance could potentially be (or is already) helpful for this application. Mention some specific characteristics of the human example.