1) On what instrument are the octaves stretched?
   a) clarinet
   b) oboe
   c) flute
   d) trumpet
   e) piano

2) A plot of airflow (on the vertical axis) versus the difference between mouth pressure and mouthpiece pressure (on the horizontal axis) for a clarinet is shown below. Which region shown on the plot could be used to play the clarinet:

   a) the region labeled A.
   b) the region labeled B.
   c) the region labeled C.
   d) the region labeled D.
   e) Any of the four regions could be used depending on loudness.

3) A trumpet resonance spectrum is shown below.
It is easier to play C below the staff than to play C above the staff because:

- a. there are more resonance peaks coinciding with the harmonics of C below the staff.
- b. there are more resonance peaks coinciding with the harmonics of C above the staff.
- c. the harmonics of C above the staff are more closely spaced.
- d. the harmonics of C below the staff are more widely spaced.
- e. the player needs more practice (not correct!)

4) Which of the following is NOT a result of including a bell on the end of a trumpet? (That is, which of the following is NOT CORRECT.)

- a. The bell changes the heights of the resonance peaks.
- b. The bell changes the locations of the resonance peaks.
- c. The bell diminishes the Bernoulli effect for pressure oscillations.
- d. The bell allows for more efficient radiation of sound from the horn.
- e. The bell moves the outer pressure node ("turning point") inside the horn.

5) A “register hole” on a woodwind instrument

- a. divides the instrument into two equal halves, doubling all of the frequencies.
- b. completes the tone lattice pattern.
- c. enables the reed to be removed.
- d. is located near pressure anti-nodes for lower frequency resonances.
- e. is located near pressure nodes for lower frequency resonances.

6) The sound spectrum of a flute is similar to that of a:

- a. cylindrical pipe open on both ends.
- b. cylindrical pipe open at one end and closed at the other.
- c. closed cylindrical pipe attached to highly flared bell.
- d. tuning fork struck forcefully.
- e. circular Chladni plate.

7) The function of the “cork” in a flute is:

- a. to rotate the position of the embouchure hole.
- b. to change the register.
- c. to change the pattern of the sound waves inside the flute shifting shorter wavelengths by a larger amount as the cork is moved.
- d. to change the pattern of the sound waves inside the flute shifting longer wavelengths by a larger amount as the cork is moved.

8) Vibrations of the glottal opening are sustained by:

- a. pressure pulses reflected from the pharynx cavity.
- b. pressure pulses reflected from the mouth cavity.
- c. pressure pulses reflected from both the pharynx and mouth cavity.
- d. pressure changes in the glottis due to the Bernoulli effect.
- e. pressure pulses reflected from the trachea.
9) In the English language, vowel sounds are determined by:
   a. the pitch of the vowel as it is spoken.
   b. the change in pitch of a vowel as it is spoken.
   c. formant frequencies.
   d. changes in the intensity of the sound as the vowel is spoken.
   e. changes in the phase of the sound wave as the vowel is spoken.

10) In a piano there are several strings struck simultaneously for most notes (three strings is typical). How are the three strings for middle C be tuned normally and why?
   a. They are tuned to exactly the same frequency (no beats) for a strong sound.
   b. They are tuned so that the beat frequency between adjacent strings is about 10 to 20 beats per second for a brilliant (?) sound.
   c. They are tuned to very slightly different frequencies to reduce how rapidly energy is coupled to the soundboard so the note lasts longer.
   d. They are tuned by 5'ths for a richer harmonic spectrum.
   e. One is tuned an octave below middle C, one an octave above middle C and one exactly at middle C.

11) The “singer’s formant,” which allows a singer to be heard above a symphony orchestra, relates to the singer’s developing a vocal tract resonance for frequencies in the range of about
   a. 150-300 Hz  b. 500-1000 Hz  c. 2000-3000 Hz  d. 5000-8000 Hz

12) At the top of the soprano range, it is difficult to distinguish vowels because
   a. the soft palate muffles the sound.
   b. it is almost out of the frequency range of the ear.
   c. the epiglottis distorts the spectrum above 1 kHz.
   d. the frequency is above the voice formant frequencies.
   e. the singer’s teeth begin to vibrate distorting the spectrum.

13) A mass $m=0.25$ kg is attached to an ideal spring and the mass-spring system undergoes simple harmonic motion. If the mass is increased by a factor of four to 1.0 kg, how will the frequency of oscillation change?
   a. It does not change.
   b. It goes up (faster oscillations) by a factor of four.
   c. It goes up (faster oscillations) by a factor of two.
   d. It goes down (slower oscillations) by a factor of four.
   e. It goes down (slower oscillations) by a factor of two.

14) Suppose a pulse of high pressure is traveling down a cylindrical tube and hits the end of the tube that is open to the atmosphere. Describe the reflection.
   a. The pulse becomes inverted (i.e., a low pressure pulse) and is reflected back to the other end of the cylinder.
b. The pulse remains the same (a high pressure pulse) and is reflected back to the other end of the cylinder.

c. There is no reflection if the tube is open to the atmosphere.

d. High frequencies give a high-pressure reflected pulse, but low frequencies give an inverted (low-pressure) reflected pulse.

15) Suppose a single bugle plays taps at dusk in City Park. Assume that the sound radiation pattern is roughly spherical, and you are standing 50 feet from the bugler. How far from the bugler would you stand to decrease the sound intensity by a factor of 4?
   a. 60 ft  b. 75 ft  c. 100 ft  d. 200 ft  e. 400 ft

16) At the low frequency end of a piano the intervals are not as consonant as they are in the middle of the piano. Why?
   a. It is difficult to tune the low end properly.
   b. The soundboard introduces dissonance because of its complex vibrations at low frequencies.
   c. The critical bandwidth stays approximately constant at frequencies below 100 Hz, yet the intervals get closer together. Hence two notes may fall in the same critical band.
   d. The ossicles can themselves vibrate in resonance at low frequencies.
   e. There are no formants at these frequencies.

17) Which scale has a circle of fifths which closes exactly?
   a. just intonation scale
   b. meantone intonation
   c. equal temperament scale
   d. Pythagorean scale
   e. none of the above

18) For an equal temperament scale, the frequency ratio between ½ steps is 1.0595. Suppose we are designing our own instrument, somewhat like a guitar. The distance between the nut and the bridge is 0.8 meters for an A string. What is the distance between the first fret (playing an A#) and the nut?
   a. 0.713 meters
   b. 0.755 meters
   c. 0.673 meters
   d. 0.600 meters
   e. 0.790 meters

End of exam!
End of course!

Have a good Winter Break!