Test ID: TESTID Name: _____

MAT 120 **Midterm Exam Part 2** Fall 2018

1. If F_1 and F_2 are frequencies, with $F_1 < F_2$, and the frequency ratio F_2/F_1 is measured as x cents, then these numbers can be related in which of the following formulas:

   a) $2^x = 1200\dfrac{F_2}{F_1}$ b) $1200 \cdot 2^x = \dfrac{F_2}{F_1}$ c) $x = 1200 \cdot \ln\left(\dfrac{F_2}{F_1}\right)$ d) $1200 \cdot \ln 2 = \dfrac{F_2}{F_1}$ e) $\ln\left(\dfrac{F_2}{F_1}\right) = \dfrac{\ln 2}{1200}x$

   Correct Answer: $\ln\left(\dfrac{F_2}{F_1}\right) = \dfrac{\ln 2}{1200}x$

2. Approximately how many just semitones with frequency ratio $\frac{25}{24}$ fit into the interval of one Just Major third?

   a) 3 b) 4 c) 5 d) 6 e) 7

   Correct Answer: 5

3. Suppose a guitar is tuned so that there are just perfect fourths between the pairs of strings starting with the lowest string E, which are the intervals: $E \to A$, $A \to D$, $D \to G$. Also assume that the high E string is tuned exactly two octaves higher than low E string, and the next two strings below it are tuned in Just perfect fourths, at B and G. Find the cent value of the major third interval between the G and B strings, to the nearest whole cent value.

   a) 375 b) 386 c) 395 d) 402 e) 408

   Correct Answer: 408

4. In the meantone scale, if the semitone was taken to be exactly half of the whole tone cent value, how far off in cents would the octave be?

   a) 41 b) 53 c) 38 d) 57 e) 45

   Correct Answer: 41

5. Suppose a Just quarter-tone is defined to be half of the cent value of a Just Major whole tone. What should the frequency ratio for this quarter-tone be?

   a) $\frac{\sqrt{3}}{4}$ b) $\frac{3}{4}\sqrt{2}$ c) $\frac{\sqrt{2}}{3}$ d) $\frac{3}{4}$ e) $\sqrt{\frac{3}{4}}$

   Correct Answer: $\frac{3}{4}\sqrt{2}$

6. A harmonic tone X is played together with another harmonic tone Y such that Y has fundamental frequency which is 1.26 times that of X. If X has fundamental frequency 300 Hz, how many beats should we hear per second?

   a) 8 b) 6 c) 4 d) 12 e) 2

   Correct Answer: 12

7. How many beats per second should you hear between the 17th harmonic of B flat and the 18th harmonic of A 220, just below middle C on the piano?

   a) 5.4 b) 4.4 c) 3.4 d) 1.4 e) 2.4

   Correct Answer: 2.4

8. In the Just Chromatic Scale how many times does the 6/5 minor third occur from one degree of the scale to another within the span of one octave only?

   a) 5 b) 3 c) 4 d) 2 e) 1

   Correct Answer: 4

9. Suppose that four notes in a chord have fundamental frequencies 400, 500, 600, and 700 Hz. Which of the following intervals between notes in this chord is *closest* to an equal-tempered interval: i) between 400 and 500, ii) between 500 and 600, iii) between 600 and 700, iv) between 400 and 600, or v) between 500 and 700?

   a) i) b) ii) c) iii) d) iv) e) v)

   Correct Answer: iv)

10. Same chord as in the previous question. Which interval is the *farthest* from an equal-tempered interval?

    a) i) b) ii) c) iii) d) iv) e) v)

    Correct Answer: iii)

The Meantone Major (Diatonic) Scale

$$\frac{1}{1} \longrightarrow \sqrt{\frac{5}{4}} \longrightarrow \frac{5}{4} \longrightarrow \frac{\sqrt{2}}{\left(\frac{5}{4}\right)^{\frac{1}{4}}} \longrightarrow \sqrt{2}\left(\frac{5}{4}\right)^{\frac{1}{4}} \longrightarrow \sqrt{2}\left(\frac{5}{4}\right)^{\frac{3}{4}} \longrightarrow \sqrt{2}\left(\frac{5}{4}\right)^{\frac{5}{4}} \longrightarrow \frac{2}{1}$$

$$\left(\sqrt{\frac{5}{4}}\right) \quad \left(\sqrt{\frac{5}{4}}\right) \quad \left(\frac{\sqrt{2}}{\left(\frac{5}{4}\right)^{\frac{5}{4}}}\right) \quad \left(\sqrt{\frac{5}{4}}\right) \quad \left(\sqrt{\frac{5}{4}}\right) \quad \left(\sqrt{\frac{5}{4}}\right) \quad \left(\frac{\sqrt{2}}{\left(\frac{5}{4}\right)^{\frac{5}{4}}}\right)$$

The Just (Natural) Chromatic Scale

$$\frac{1}{1} \longrightarrow \frac{16}{15} \longrightarrow \frac{9}{8} \longrightarrow \frac{6}{5} \longrightarrow \frac{5}{4} \longrightarrow \frac{4}{3} \longrightarrow \frac{64}{45} \longrightarrow \frac{3}{2} \longrightarrow \frac{8}{5} \longrightarrow \frac{5}{3} \longrightarrow \frac{16}{9} \longrightarrow \frac{15}{8} \longrightarrow \frac{2}{1}$$

$$\left(\frac{16}{15}\right)\left(\frac{135}{128}\right)\left(\frac{16}{15}\right)\left(\frac{25}{24}\right)\left(\frac{16}{15}\right)\left(\frac{16}{15}\right)\left(\frac{135}{128}\right)\left(\frac{16}{15}\right)\left(\frac{25}{24}\right)\left(\frac{16}{15}\right)\left(\frac{135}{128}\right)\left(\frac{16}{15}\right)$$