

MUS/COM/ELE 369G Technologies and Music Exam #1 Spring 2019 Name: Sample Solution

Open book/notes (14 questions, 7 points each, plus 2 points for entering your name above)

1. (**C**) Which of the following is a percussion instrument that belongs to the idiophone category as well as the mallets category? (A) timpani, (B) vibraphone, (C) triangle, (D) bass drum, (E) none of the above.

An idiophone is an instrument the whole of which vibrates to produce a sound when struck, shaken, or scraped, such as a bell, gong, or rattle. A mallet is a wooden or plastic stick with a rounded head, used to play certain percussion instruments such as xylophone and marimba.

2. (**D**) In an orchestra, which of the following instruments usually gives the A440 note as the tuning reference? (A) clarinet, (B) tuba, (C) cello, (D) oboe, (E) none of the above.

The A440 is usually given by the oboe. In the case of a small orchestra or ensemble without an oboe, the tuning reference is usually given by the first violin.

3. (**A**) Which of the following was the first brass instrument consistently used by composers in orchestras? (A) French horn, (B) tuba, (C) trumpet, (D) trombone, (E) none of the above.

See Prof. Aberdam's slides.

4. (**A**) One of the early tuning systems based purely on the perfect fifths (i.e. with the 3/2 ratio) is: (A) Pythagorean tuning, (B) meantone temperament, (C) just intonation, (D) well temperament, (E) none of the above.

Pythagorean tuning is a system of musical tuning in which the frequency ratios of all intervals are based on the ratio 3:2, the next simplest ratio after 2:1. This ratio, also known as the "pure" perfect fifth, is chosen because it is one of the most consonant and easiest to tune by ear. When extending this tuning however, a problem arises: no stack of 3:2 intervals (perfect fifths) will fit exactly into any stack of 2:1 intervals (octaves). Thus, other tuning systems were developed to provide a compromise between the best consonance and the extendability over several octaves.

5. (**B**) Which of the following statements is correct? (A) Tempo and rhythm basically mean the same and are used interchangeably. (B) Tempo is the speed a piece of music is performed, while rhythm is the placement of sounds in time in a repeated pattern. (C) Rhythm is the speed a piece of music is performed, while tempo is the placement of sounds in time in a repeated pattern. (D) Temple is the pattern of the repetition and rhythm is the speed of the repetition. (E) none of the above. See Prof. Aberdam's slides.

6. (**C**) Which of the following is not one of the areas of technology studies? (A) design/production, (B) mediation, (C) political science, (D) consumption/use, (E) none of the above. From Prof. Reyes' lecture.

7. (**C**) Technology and music have a few common properties. Which of the following is not one of them? (A) Both do not have objects. (B) Both have complex social, cultural, and economic relations. (C) Both are based on science and engineering. (D) Both are fundamental to humanity. (E) none of the above. From Prof. Reyes' lecture. Music has some relevance to science (especially mathematics), but not so much to engineering.

8. (**D**) Which of the following could be a good argument against the sentiment of "technology is killing music?" (A) Technology has not affected the development of music. (B) The limited range of sounds built into synthesizers dictates the music in a particular style. (C) Everyone's work begins to sound like the same. (D) Electric guitarists have used feedback and distortions to create new sounds. (E) none of the above.

See handout "03b_E Theberge - Technology, Consumption, _ Musical Practice."

9. (**C**) According to the paper “Can economic theory explain piracy behavior?” by Håkan Holm, which of the following statements is incorrect? (A) Piracy behavior is more intense for people with a low net valuation of an original. (B) Piracy behavior is more intense for people with computer skill. (C) Piracy behavior is more intense for female. (D) The subjects’ ethical concerns regarding piracy has no statistically significant effect on piracy behavior. (E) none of the above.

See handout “04a_E_EconomyTheory,” Concluding Remarks, p. 11.

10. (**B**) A chord consists of 3 notes: D, F, and A. Which chord is it? (A) D major, (B) D minor, (C) F minor, (D) A diminished, (E) none of the above.

See handout “04c_MathematicsTemperament,” p. 9. The root note is D. The D-F interval is 3 half steps, and the F-A interval is 4 half steps. Thus, it is a minor chord.

11. (**B**) The A4 note of a musical instrument is 20 cents below the A440. What is the actual frequency of this A4 note? (A) 438 Hz, (B) 435 Hz, (C) 430 Hz, (D) 420 Hz, (E) none of the above.

See handout “04c_MathematicsTemperament,” p. 2. We begin with the equation:

$$\frac{f_2}{f_1} = 2^{(c_2 - c_1)/1200} . \text{ We have } c_2 - c_1 = -20 \text{ cents, and let } f_1 = 440 \text{ Hz. Thus,}$$

$$\frac{f_2}{440 \text{ Hz}} = 2^{-20/1200} \Rightarrow f_2 = 2^{-20/1200} \times 440 \text{ Hz} \Rightarrow f_2 = 0.9885 \times 440 \text{ Hz} \Rightarrow f_2 = 435 \text{ Hz}$$

You can do this calculation in spreadsheet by entering “=440*2^(-20/1200)”.

12. (**A**) The A2 note of a musical instrument is 20 cents below the standard A2 (110 Hz). What is the actual frequency of this A2 note? (A) 109 Hz, (B) 107 Hz, (C) 100 Hz, (D) 90 Hz, (E) none of the above.

Similar to the previous question:

$$f_2 = 2^{-20/1200} \times 110 \text{ Hz} \Rightarrow f_2 = 0.9885 \times 110 \text{ Hz} \Rightarrow f_2 = 109 \text{ Hz}$$

Notice that a 20-cent flat means the frequency is lower by 5 Hz at A4 (440 Hz), and by only 1 Hz at A2 (110 Hz).

13. (**C**) The frequency of the G string of a guitar should be 98 Hz under A440 tuning. If the G string is tuned at 95 Hz, how many cents is it flat? (A) 12 cents, (B) 38 cents, (C) 54 cents, (D) 71 cents, (E) none of the above.

Now we use the equation $c_2 - c_1 = 1200 \log_2 \frac{f_2}{f_1}$. Let $f_2 = 95 \text{ Hz}$ and $f_1 = 98 \text{ Hz}$.

$$c_2 - c_1 = 1200 \log_2 \frac{95}{98} = -53.825 \dots = -54 \text{ cents. The negative sign means that it's flat.}$$

You can do this calculation in spreadsheet by entering “=1200*log(95/98;2)”.

14. (**A**) One cello produces a sound intensity of 80 dB. What is the combined sound level with 4 cellos playing together in unison? (A) 86 dB, (B) 92 dB, (C) 100 dB, (D) 160 dB, (E) none of the above.

Let the sound level of 1 cello be x . $80 \text{ dB} = 10 \log_{10} x \Rightarrow x = 10^{80/10} = 10^8$. The sound level of 4 cellos is $4x$. $10 \log_{10} 4 \times 10^8 = 86 \text{ dB}$. Enter “=10*log(400000000)” in the spreadsheet.

Another way to do this is by applying the multiplication law of logarithms:

$$10 \log_{10} 4x = 10 \log_{10} 4 + 10 \log_{10} x = 6 \text{ dB} + 80 \text{ dB} = 86 \text{ dB}.$$