

SYST 460/560 – Homework – Aviation Noise

1. Logarithms are used for measuring sound pressure because they
 - a. Convert small numbers into large numbers
 - b. Compress a scale with a wide range of numbers into a manageable range
 - c. Expand a scale with a narrow range of numbers into a manageable range
 - d. Adjust for outliers to make for a manageable range

2. The equation for Decibels is shown below

$$\text{dB} = 20 \log (a/b).$$

The variables **a** and **b** represent:

- a. a = Actual Sound Pressure, b = Reference Sound Pressure
 - b. a = Reference Sound Pressure, b = Actual Sound Pressure
 - c. a = Actual Sound Pressure, b = Speed of Sound
3. The Sound Pressure in Decibels of a lawn mower with Sound Pressure of 1 Pa is

$$L_p = 20 \log (\text{_____} / \text{_____}) = \text{_____} \text{ dB}$$

4. The Sound Pressure in Decibels of the quietest sound audible by the human ear with Pressure of 0.00002Pa is

$$L_p = 20 \log (\text{_____} / \text{_____}) = \text{_____} \text{ dB}$$

5. The symbol for A-Weighted noise levels is

- a. dBA
- b. A-dB
- c. dB_A

6. The A-Weighted noise levels accounts for peculiarities of the way the human ear perceives noise by weighting:

- a. Pressure and Temperature
- b. Frequency and Duration
- c. Pressure and Frequency
- d. Frequency and Power

7. Match each term of calculation with its definition

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- a. L_{\max} _____ takes into account all the noise readings during a given time period for a given sound event
- b. SEL _____ a generic measure of cumulative sound events
- c. L_{eq} _____ a generic measure of cumulative sound events adjusted for night-time noise
- d. L_{dn} _____ measures the highest sound level reached during a given time period

8. Match each term of calculation with its correct formula

- A. L_{dn} _____ $10 \cdot \log \left(\frac{1}{T} \sum_{j=1}^M 10^{SEL_j/10} \right)$
- B. L_{\max} _____ $10 \cdot \log \left(\int_0^T 10^{L(t)/10} dt \right)$
- C. SEL _____ $10 \cdot \log \left[\frac{1}{86,400} \left(\sum_{j=1}^J 10^{SEL_j/10} + \sum_{k=1}^K 10^{(SEL_k+10)/10} \right) \right]$
- D. L_{eq} _____ $\max_{0 \leq t \leq T} L(t)$

9. The readings of a noise sensor near an airport during the 15 “loudest” seconds of a noise event are given below. Readings are in dBA taken a 1-s intervals

1	2	3	4	5	6	7	8	9	10	11	12
81.6	91.3	73.4	94.7	94.2	93.3	72.9	85.8	73.1	83.7	72.9	71.1
13	14	15									
79.3	98.4	73.1									

First, identify L_{\max} , then find the SEL

10. Consider the situation in which 10 noise events generated by landing and departing aircraft occurred at a particular location, 8 during daytime and 2 during nighttime. The associated SEL values are 74.2, 72.9, 72.5, 83.7, 87.6, 85.9, 76.1, and 78.2 dBA for the daytime events and 79.4, and 88.8 dBA for the nighttime events. Assume that the first three daytime events took place between 10 and 11 AM. First, find the equivalent sound level (L_{eq}) and then find the day-night average sound level (L_{dn}).

11. All of the following mitigate airport noise by:

- A. Noise monitoring systems _____ influencing airports to operate within stated noise ranges by giving them money for following these ranges and penalizing them when they don't

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- B. Community relations and public participation programs _____ soundproofing surrounding buildings and acquiring surrounding property through the real estate market or by applying eminent domain
- C. Land-use policies _____ demonstrating to the public at large an airport's concern about its negative environmental impacts and its commitment to alleviating problems in concert with the affected communities
- D. Airport design interventions _____ Allowing noise at airports to be reported and recorded to a central computer for noise analysis and reporting
- E. Surface operations and flight operations _____ inhibiting the way an airport operates by placing limitations on the aircraft types at an airport and the times of day an airport can operate
- F. Interventions outside airport property _____ reducing noise impacts on airport neighbors by a number of possible modifications, adjustments, or additions to the physical layout and structures on the airport property
- G. Access restrictions _____ applying proactive action that attempts to anticipate future problems and attempt to forestall them through judicious planning in the form of zoning restrictions and building codes
- Economic incentives _____ placing restrictions on both noise and engine emissions