

PHY2010 HW 6. Dr. Hawley's Answers

1. Match the following acoustical concepts with their definitions

- |                            |  |
|----------------------------|--|
| Liveness – <b>h.</b>       | a. First reflected sound arrives <20ms after direct            |
| Shadows – <b>j.</b>        | b. Large reflected sounds which yield poor texture             |
| Texture – <b>f.</b>        | c. Results from reflections off curved walls                   |
| Brilliance – <b>g.</b>     | d. Results from poor acoustical isolation from environment     |
| Clarity – <b>i.</b>        | e. Intensity of reflected sound is high rel. to that of direct |
| Focusing – <b>c.</b>       | f. Temporal pattern of sounds; good is a smooth decay          |
| Fullness – <b>e.</b>       | g. Reverb time of low end is shorter than normal               |
| Blend – <b>k.</b>          | h. Physically measurable reverb time                           |
| External noise – <b>d.</b> | i. Intensity of reflected sound is low rel. to that of direct  |
| Intimacy – <b>a.</b>       | j. Regions with poor high end mix due to obstructions          |
| Echoes – <b>b.</b>         | k. Quality of the mix of instruments throughout the audience   |

2. You're building a church with a "rectangular barn" sanctuary with sides 100ft x 50ft x 40ft. Choose the value closest to the "ideal" reverberation time: (Hint: You can "read" this off Figure 8-4 in the text.)

- |          |          |                 |
|----------|----------|-----------------|
| a. 1.5 s | b. 2.2 s |                 |
| c. 1.0 s | d. 1.9 s | <b>e. 1.7 s</b> |

3. Your home studio is 10ft x 12ft x 8ft. What are the frequencies of the five *lowest-frequency* room modes? (Use 1130 ft/s for the speed of sound.)

<b>nx</b>	<b>ny</b>	<b>nz</b>	<b>Freq. (Hz)</b>
<b>0</b>	<b>0</b>	<b>1</b>	<b>70.6</b>
<b>0</b>	<b>1</b>	<b>0</b>	<b>47.1</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>56.5</b>
$\emptyset$	$\emptyset$	<b>2</b>	<del>141.3</del>
<b>0</b>	<b>1</b>	<b>1</b>	<b>84.9</b>
$\emptyset$	<b>2</b>	$\emptyset$	<del>94.2</del>
$\pm$	$\emptyset$	$\pm$	<del>90.4</del>
<b>1</b>	<b>1</b>	<b>0</b>	<b>73.5</b>

4. Chim E. Changa's Restaurant & Kiddie Fun Zone\* features a large Romper Room which is 50 feet long, 25 feet wide and 12 feet high.

- a. The floor is made of tile (a=0.08) and walls and ceiling are made of plasterboard (a=0.10). If you also add in the absorption due to 50 children, with an absorption of 2.1 Sabins each, what is the reverb time in the Romper Room?

$$T_R = \frac{0.050(50)(25)(12)}{(0.08)(50)(25) + (0.10)[2(50)(12) + 2(25)(12) + (50)(25)] + (50)(2.1Sab)}$$

$$= \frac{0.050(15000)}{510} = 1.47 \approx 1.5 \text{ sec}$$

- b. In response to a class-action lawsuit from employees who claim hearing damage from the *deafening* reverberant noise of shrieking, bean-encrusted young'uns, the management has decided to add absorption in the form of acoustical board ( $a=0.80$ ) on the ceiling, and curtains ( $a=0.35$ ) along both long walls. What will the new reverberation time be?

$$T_R = \frac{0.050(50)(25)(12)}{(0.08)(50)(25) + (.80)(50)(25) + (0.10)[2(25)(12)] + (0.35)(2)(50)(12) + (50)(2.1Sab)}$$
$$= \frac{0.050(15000)}{1685} = 0.45\text{sec}$$

*\*cf. "Kickin' It Old Skool," starring Jamie Kennedy*