**PHY2010 - Physics for AET, Activity: Room/Hall Design**

**Materials**:

Download the file RoomHallDesign.xlsspreadsheet in Microsoft Excel

**The Task:**

A client wants to build a rectangular auditorium, and has hired you to design and construct it. You need to have a reverberation time acceptable for the purposes of the room (i.e. long enough but not too long), over a range of frequencies, when people are in the room. …And you need to stay on budget!

**Directions:**

1. Decide on the type of hall to design: Church, Lecture Hall, Chamber Music Hall, or Romantic Music Hall. Type this into the space provided in the upper right corner of the spreadsheet. Also update cell D40 to show the correct income per person, according to the table below. Note: The “church” gets to build pews, and can change the seating cost in cell B35 to $10/seat.
2. Decide on roughly how many people you want your hall to hold, and determine a rough set of dimensions (L x W x H) for the hall. Make sure to leave adequate floor space for your audience – consider that each person will use about 6 ft2, and you’ll want room for a stage and aisles! Enter the audience number into cell C13.
3. Enter these dimensions into the spreadsheet, which will calculate the volume of the room. By referring to Figure 8-4 on page 218 of the Berg & Stork Text, determine the “Ideal Reverb Time” for a room of your type given your volume. Type this in, in the upper right corner of the spreadsheet.
4. Look to the right in the spreadsheet and see the graph of reverb time vs. frequency. Your goal will be to have the mid-to-high frequencies match the “Ideal Reverb Time,” with the low-frequency reverb time roughly 0.2s larger than this – *while staying on budget*.
5. Your budget is displayed below on the spreadsheet in cell F42: green for under-budget (good), red for over-budget (bad).
6. To reach your goal, change out the materials on the walls, floor and ceiling by selecting from the drop-down menus in B14-B19. A graph of the absorption coeffeicients for these materials is provided in the lower right of the spreadsheet. You may also need to adjust your room dimensions.
7. Proceed by trial-and-error until your room meets the design specifications!

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Income (per seat):** |  |  | **Construction Costs:** |  |
| Church: | $270 |  |  |  |
| Lecture Hall | $270 |  | **Volume Cost (per ft3):** | $0.65 |
| Chamber Music Hall | $300 |  |  |  |
| Romantic Music Hall | $300 |  | **Surface Costs (per ft2):** |  |
|  |  |  | Concrete | $0.50 |
|  |  |  | Glass | $4.00 |
|  |  |  | Plasterboard/Plywood | $0.35 |
| *(Optional RPG classes:* |  |  | Carpet | $0.75 |
| *Cleric – Church* |  |  | Curtains | $0.80 |
| *Wizard – Lecture Hall* |  |  | Acoustical Board | $1.25 |
| *Bard – Romantic M. Hall* |  |  |  |  |
| *Monk - Chamber Hall)* |  |  | **Other items (each):** |  |
|  |  |  | Upholstered Seat | $50.00 |
|  |  |  | Pew, per person(church) | $10.00 |