"Band-in-a-Box" Design Project

Description

The hottest band in the town of Sparkyville is "Maroon (and Gold) 4". They are known for their musical experimentation and unique instruments. They plan to go on tour and would like to minimize the space required for their musical instruments. Your company has been hired by Maroon (and Gold) 4 to design the instruments for their new tour. Your team must design 3 (for teams of 3) or 4 (for teams of 4) instruments (one for each part of the song) capable of playing at least one of their hit songs, "Ode to Joy", "ASU Alma Mater", and/or "ASU Fight Song". **Please note that a complete "design" is one that consists of the entire set of all 3 or 4 instruments (for all project documents when the term "design" is used, it refers to sets of 3 or 4 instruments).** Each of the three types of instruments (wind, percussion, and string) must be represented in your design and they must be designed in such a way that they will all (i.e., your design) fit into ONE 2ft x 2ft x 2ft stage box. Your design should cost as little as possible and be aesthetically pleasing. Creativity and innovation are encouraged and rewarded. You will be required to demonstrate your design by playing one of their hit songs and combining (and possibly editing) audio files to create a cover track of the song so that they will know how it will sound before going on tour. You will also be required to document and demonstrate each individual instrument as a part of the project.

Project Specifications

Each person on the team must create an instrument for the team's design. There should be one instrument per part in the musical scores (except for the ASU Fight Song in which one (or two if you are designing 3 instruments) instrument(s) will have to be able to play two parts since there are 5 parts in the song). Within each team at least one instrument in the design needs to be a wind instrument, at least one needs to be a percussion instrument (bar based percussion), and at least one needs to be a string instrument. Individual instruments in the design only need to be designed to play the notes in the song, but can be designed to play more notes, if desired. **Physical principles and mathematical calculations (from the Acoustics unit) should be used to guide your design decisions**. Please note that drums are membrane based percussion instruments, which are beyond the scope of this course, thus, the physics behind drums will NOT be introduced. You must build your own instrument. Buying pre-made instruments or instrument making kits is not allowed. Using websites that contain instructions on how to build a specific instrument may be used to get ideas for your design; however, such sources MUST be cited and may lower the "creativity" of your design. You must make sure that your designs do indeed meet the requirements of this particular project.

You will have to be able to play the song your team chooses, but if you want to automate the song, that is acceptable (for example, a music box). You will only be assessed based on one of the songs, so you will pick your best one for demonstration. Your team is required to create a track (song will all instruments playing their different parts) of one of the 3 songs mentioned in the Description. Sheet music, a listing of the notes, and .mp3 files of the songs and the individual parts will be provided for your reference (under Project Documents on the course shell). There will be different points available depending on the song recorded (more points available for harder songs). Be sure to refer to the Prototype Rubric for the specific point criteria. You may use the free program, Audacity (http://www.audacityteam.org/) to record, edit, process, export, play, and combine audio files. There are tutorials and manuals describing how to use this program under the help tab at the URL provided. Types of editing and processing that could be done include filtering, small frequency adjustments, piecing together song segments, etc.

Resource Limitations

For team of 4, your design should have 4 instruments, and as a team you must be able to prove that your design (with all 4 instruments) will fit within the 2ft x 2ft x 2ft stage box. This will most likely be done with a sketch and packing instructions. As an entire team, you cannot use any more than 10ft of pipe (of any diameter or material) and 6ft of piano wire/guitar strings (of any gauge or material) in the set of instruments. Even if the material is not being used for sound creation, it still must be considered in these constraints (for instance, if you are using PVC pipe for the structure of your string instrument, you must include that length in the pipe constraint).

To make the limitations mentioned above equivalent, for teams of 3 your design should have 3 instruments and one of the 3 instruments will play two parts. For the instrument that is playing two parts, it has to be counted twice in the 2ft x 2ft x 2ft box**. You are NOT required to build the duplicated instrument twice, just count it twice for the stage box**. You must prove that all 3+1 instruments fit in the stage box and this will most likely be done with a sketch and packing instructions. As a team, you cannot use any more that 8ft of pipe (of any diameter or material) and 4ft of piano wire/guitar strings (of any gauge or material) in these 3 instruments.

For teams of 2, please contact instructors immediately, to learn about expectations and resource limitations.

Budget & Supplies

You are required to track all expenses related to the construction of your instrument for inclusion in a team budget. **Individuals cannot spend more than $15 on their instrument** (tax and shipping costs should not be included in your budget) and every material used (even if pulled from the trash) must have a value associated with it and be included in the budget. Discuss value of recycled items with instructor **before** using them in your design. Note that $15 is the maximum budget, but not the dollar amount for achieving maximum points on the prototype. Only materials used in the design need to be included in the budget (for instance, if you buy 20 nails and only use 5 in your design, take the total cost multiplied by 5/20 for the amount that will be in your budget). Adhesives and tapes do not need to be included in the budget unless the cost of the tapes/adhesives are the predominate expense of the design (if your entire instrument is made of duct tape, then you should take that into account). There is a flat $1 painting/color fee, regardless of the amount of paint/ink used.

Project Evaluation

Each team's design will be evaluated based on quality of tone produced by all the instruments in the design, overall quality of the track, total cost of the design, creativity, and the aesthetics/craftsmanship of all the instruments in the design. Your team will also be evaluated on the ability to clearly communicate your design/results in both oral and written form throughout the project.

Besides creating a functioning prototype of your design, your group will be required to provide various intermediate project deliverables throughout the project (see Project Grading Details table below). These intermediate deliverables are designed to aid you in working through the design process. You will be given documents (under Project Documents on the course shell) detailing what will be expected for each of these deliverables. In addition to written project deliverables, your team will also be expected to give two short oral presentations (recorded and uploaded to YouTube or Vimeo) on your design as well as write a technical report on your design. Due dates for all project deliverables are included in the weekly schedule on the course shell, so please be sure to check them out.

All project deliverable are to be completed and submitted as a team and are due on the dates and times specified (note again that all due dates and times are for Arizona MST). Each team member is expected to contribute to the content of each of the team deliverables in order to receive credit for the assignment. The extent to which each person is expected to contribute on an assignment is left up to the team. If a team member fails to contribute to a project deliverable, the person's name should NOT be included in the assignment and that person will receive zero credit for the assignment.

You will be required to keep a record of team collaboration in a team design notebook, which will be updated and checked weekly. The document describing the expectations for this design notebook is posted on the course shell along with the other project related documents. It is also highly recommended that your team keep detailed notes of your design process in your team's notebook. It is expected that **everyone** on the team will contribute to the contents of the design notebook. Design notebook entries will be used by the instructor(s) to judge the effectiveness of your team and help teams maintain good team dynamics. Failure of individuals to update the team notebook weekly may result in lower weighting in their final project grade (as described in the Project Grading Details below).

Project Grading Details

As stated above, you will have various deliverables, which make up your project grade. The following table details how the grading of your project will be determined. **Individual grades will be based on the team's grade and the individual's contribution to the team (evaluation of individual contributions will be based on peer evaluations, team design notebook entries, and instructor(s) observations)**. Team raw total project grade will be scaled (either up or down) for each individual in the team at the end of the semester.

Assignment	**Points Available**
Project Deliverable 1: Problem Definition & Requirements	20
Project Deliverable 2: Project Schedule (Gantt Chart)	20
Project Deliverable 3: Project Proposal • Part 1 – Team Presentation of Proposed Design (45 points) • Part 2 – Documentation of Proposed Design, incl. revisions (50 points)	95
Project Deliverable 4: Progress Report Memo	20
Final Design Prototype * • Meeting design requirements (system functionality, performance, etc.) • Craftsmanship • Aesthetics • Creativity • Cost	135
Project Deliverable 5: Final Oral Presentation (Demonstration)	25
Project Deliverable 6: Final Design Report	135
Total	**450**

Note: Grading details for the project proposal, final oral presentation, and final design report are provided in additional documents on the course shell

*Please see Final Prototype Grading document (under Project Documents on the course shell) for details.