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| 分数系数说明：<br>1.答辩时间及相关评分说明：<br>1-1. 支持项目提前至15周答辩，在15周实验课上完成答辩则项目总分*1.05 按比例计入总分<br>1-2. 如在16周的实验课上完成答辩，则分数不乘任何系数。<br>1-3. 如在17周周五前进行延迟答辩，则分数乘以0.7的系数。<br><br>2. 如果无法成功上板测试，则需现场提供仿真结果及相关解读，最终得分为Project score的60%~70%。<br>其他系数请参加以下单项的描述 | | | | |
| 视频录制要求：<br>(仅对需要拿bonus分数的小组有要求，视频最迟于答辩的下周之前上传至BB站点)<br>如缺少视频，bonus总分打7折 | 1. 视频时长请控制在15分钟以内，包括功能演示以及代码解读两个部分（本次视频对全员现身视频不做要求）<br>2. 功能演示<br>2-1：请参照项目"功能点"开展演示（这也是评分依据），次序自定，功能演示前需介绍开发板上和项目相关的输入输出设备的用法，建议在电脑上打开“输入输出说明图”，将摄像头对准输入输出说明图以及开发板，在演示的同时对演示场景、操作步骤以及演示结果加以说明。 | | | |
| 代码解读要求：<br>请完成1及2部分：<br>如果代码解读有问题，相关功能点为0分 | 1. 由老师在基本功能和标准功能中分别选择一段代码（至少包含一段组合逻辑、一段时序逻辑），小组成员进行解读<br>2.如果实现了bonus功能， 由老师至少挑选其中一个功能点，小组成员对该功能点的代码进行解读 | | | |
| 请注意：<br>项目文档、项目相关代码需要在答辩之前上传BlackBoard，在答辩时从BlackBoard下载现场生成bit流文件并对FPGA芯片进行烧录 | 类别 | 详细描述 | | |
| | 项目文档<br>10 points | 应包含<br>0. 团队分工（各成员工作以及贡献百分比）【0.5】，开发计划日程安排和实施情况【1】<br>1. 系统功能列表 【1】<br>2. 系统使用说明（含系统 的输入、输出端口的说明），可参考“输入输出端口说明图示例” 示意图 【1】<br>2. 系统结构说明（系统内部各模块及模块间信号线的关系）【2】<br>3. 子模块功能说明： 输入、输出端口说明、子模块功能说明 【1】<br>4. bonus 的实现说明（仅对实现bonus的小组有要求，如缺少这部分，bonus总分打7折）<br>5. 项目总结（团队合作、开发及测试工作的总结【2】<br>6. 假如你们团队负责project出题，请给出基于ego1可实现的project的想法和建议，可以借鉴网上的方案，但需给出reference【1.5】） | | |
| | 代码规范性<br>5 points | 1. project的顶层模块应该采用结构化的建模方式，合理划分模块来处理用户输入、音乐存储、控制蜂鸣器、LED、七段数码管等输出。 （未做到则总分*0.9）<br>2. 代码有必要的注释 （未做到则总分*0.9）<br>3. project中不能出现 阻塞赋值和非阻塞赋值混用，不能在时序逻辑中用阻塞赋值，组合逻辑中用非阻塞赋值。（发现一个扣2分）<br>4. 代码中尽量避免出现数字形式的常量，应该在一个文件中完成对所有符号化常量的定义，在需要使用常量的模块通过#include的方式将该文件引入，直接使用常量的名字即可。 （未做到扣2分） | | |
| | 基本功能<br>40 points | 支持在三种基本模式（自由模式、自动演奏模式、学习模式）之间做切换 | | |
| | | 随意按键，电子琴播放相应的音符，<br>例如，随意按下几个按钮，学习机播放do、re、mi等音符。(需要能够完整的演奏出do、re、mi、fa、so、la、xi 7个音符） | | |
| | | 学习机自动演奏歌曲，例如，进入自动演奏模式，自动演奏”小星星”。 | | |
| | | 根据音符顺序和持续时间点亮琴键上方的led灯，以引导用户正确演奏，<br>例如，根据”小星星”的顺序，应该turn-on灯下方对应的键，用户turn-on后对应的led灯会熄灭，然后点亮下一个音符对应的另一盏灯。 | | |
| | 标准功能<br>45 points | 自由模式下，在自由按键的基础上，电子琴播放相应的音符。<br>• 增加八度调整音符：更高的八度：按下特定键，可以弹出比原始八度更高的音符，同样适用于低八度 | | |
| | | 自动演奏模式：<br>学习机在增加音乐库的基础上自动演奏歌曲，至少可以通过切换播放两首歌曲。 | | |
| | | 自动演奏模式：<br>• 在七数码管上显示曲目编号： (5)<br>进入自动模式后，通过按键或者开关实现音乐库（曲库中至少有三首或更多歌曲）的前后翻页，七段数码管显示音乐库的内容（包括曲子的编号或者名字缩写）。 | | |
| | | • 在自动演奏时，使用灯光指示用户演奏位置和持续时间：<br>按下按钮确认曲目后，学习机开始自动演奏，当音符出现时从音符上方点亮灯光，音符演奏后熄灭灯光，直到歌曲结束。 | | |
| | | 学习模式：<br>• 在引导的基础上提高整个演奏的评级：对于每个音符，确定演奏间隔，<br>根据用户的演奏的状态，在七段数码管或LED灯上显示用户演奏水平的评级 | | |
| | | 学习模式：<br>• 在引导的基础上提高整个演奏的评级：对于每个音符，确定演奏间隔，<br>为不同用户创建账户，根据用户的演奏记录更新账户的用户评级 | | |
| | 附加创意<br>15 points | 用户可以根据他们的使用习惯调整键的位置：当学习设备进入调整模式时，设备按顺序演奏音符，如do re mi。选择与’do’相对应的音符后，按下确认按钮，机器将演奏下一个音符，等待用户再次选择并确认。完成所有确认后，用户练习期间按下的键对应的音符将与调整模式一致。 【2】 | | |
| | | 对于用户的演奏记录，可以选择是否将其保存在音乐库中： 进入录音模式，记录用户按下的键的顺序和位置，当用户按下结束键时停止录音，然后自动回放。用户按下确认键后，将其保存在设备中，以后可以通过自动播放模式重新播放它（提供删除和覆盖操作选项）【2-4】 | | |
| | | VGA显示更多关于音乐的信息以辅助指导演奏和增加趣味性： 例如，显示歌曲名称而不是编号，使用一些图形提示音符播放的时机。【5~10】 | | |
| | | 关于评分的实时更新更加精细和合理： 在学习模式中，根据用户按键的时间与标准时间的差异提供实时变化的评分。评分方法将作为评估的基础。【2】 | | |
| | | 音乐的节奏更多变化： 在自动模式和学习模式中，每个音符的持续时间可以不一致。【2】 | | |
| | | 可选，如果有实现其他创意，请在答辩中演示【1-5】 | | |
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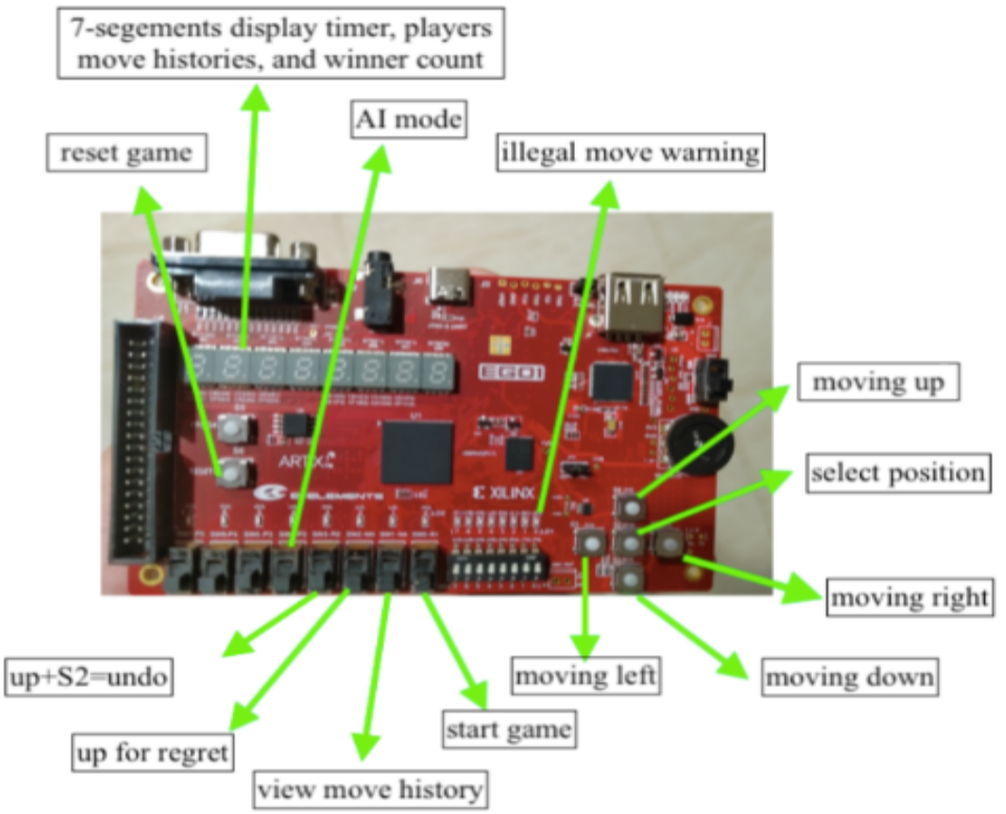
7-segements display timer, players move histories, and winner count
AI mode
reset game
illegal move warning
moving up
select position
moving right
moving down
moving left
start game
view move history
up for regret
up+S2=undo

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| Explanation of score coefficients:<br>1. Explanation of defense time and related scoring:<br>1-1. Support the project to advance the defense to 15 weeks,the total project score * 1.05 will be proportionally included in the total score<br>1-2. If the defense is completed within 16 weeks, the score will not be multiplied by any coefficient.<br>1-3. If a delayed defense is conducted before Friday of the 17th week, the score will be multiplied by a coefficient of 0.7.<br>2. If the board test cannot be successfully conducted, simulation results and related interpretations need to be provided on-site, and the final score is 60% to 70% of the Project score.<br>Please refer to the description of the following items for other coefficients | | | | |
| Video recording requirements:<br>(Requirements only apply to groups that require a bonus score, and the video should be uploaded to the blackboard before the nextweek of the defense.)<br>Lack of video,bonus total score will be reduced by 70% | 1. Please control the video duration within 15 minutes, including two parts: functional demonstration and code interpretation (this video does not require all staff to appear in the video)<br>2. Functional demonstration<br>2-1: Please refer to the "Function Points" of the project for demonstration (which is also the basis for evaluation), and the order is self determined. Before the functional demonstration, it is necessary to introduce the usage of input and output devices on the development board and related to the project. It is recommended to open the "Input and Output Instruction Diagram" on the computer, align the camera with the input and output instruction diagram and the development board, and explain the demonstration scene, operation steps, and demonstration results while demonstrating. | | | |
| Code interpretation requirements:<br>Please complete 1 and 2<br>If there is an issue with code interpretation, the relevant function points will be scored 0 points | 1. Teacher select a section of code (including at least one section of combinational logic and one sequential logic) from the basic and standard functions respectively, and the team members shall interpret it<br>2. If the bonus function is implemented, teacher select at least one of the function points, and the team members shall interpret the code of that function point | | | |
| NOTE:<br>Project documents and project related codes need to be uploaded to BlackBoard before the defense, and downloaded from BlackBoard, generate the bitstream and program the device during the defense | category | details | | |
| | project document（10%） | Should include<br>0. Team division of labor (work and contribution percentage of each member) [0.5], development plan schedule and implementation status [1]<br>1. System Function List [1]<br>2. System usage instructions (including instructions for the input and output ports of the system), please refer to the "A demo of IO ports descrip" schematic diagram [1]<br>2. System structure description (relationship between internal modules and signal lines between modules) [2]<br>3. Sub module function description: Input and output port description, sub module function description [1]<br>4. Implementation instructions for bonus (only for the team implementing bonus, if this part is missing, the total bonus score will be discounted by 70%)<br>5. Project summary (summary of team collaboration, development, and testing work)<br>6. If your team is responsible for setting project questions, please provide ideas and suggestions for projects that can be implemented based on EGO1. You can refer to online solutions, but please provide reference [1.5] | | | |
| | Code specification（5%） | 1. The top-level module of the project should adopt a structured modeling approach, reasonably dividing the modules to handle user input, music storage, control buzzers, LED, and seven segments<br>Code tube and other outputs. (If not achieved, total score * 0.9)<br>2. Necessary comments on the code (if not achieved, total score * 0.9)<br>3. Blocked and non blocking assignments cannot be mixed in the project, blocking assignments cannot be used in temporal logic, and non blocking assignments cannot be used in combinatorial logic. (Discovering one will result in a deduction of 2 points)<br>4. Try to avoid numerical constants in the code, and define all symbolic constants in one file. For modules that require constants, use # include to introduce the file and directly use the name of the constant. (2 points deducted if not achieved) | | | |
| | basic function<br>(40 points) | Support switching between three basic modes (free mode, automatic performance mode, and learning mode) | | |
| | | Press any button and the electronic keyboard will play the corresponding notes,<br>For example, by randomly pressing a few buttons, the learning machine can play notes such as do, re, mi, etc. (Need to be able to fully play 7 notes: do, re, mi, fa, so, la, xi) | | |
| | | The learning machine automatically plays songs, for example, entering automatic performance mode and automatically playing "Little Star". | | |
| | | According to the order and duration of the notes, light up the LED light above the piano keys to guide the user to play correctly,<br>For example, according to the order of "little stars", the corresponding key below the light should be turned on. After the user turns on, the corresponding LED light will go out, and then the other light corresponding to the next note will be lit. | | |
| | standard function<br>(45 points) | In free mode, on the basis of free buttons, the electronic keyboard plays the corresponding notes.<br>• Increase octave adjustment note: Higher octave: Pressing a specific key can pop up notes higher than the original octave, which is also applicable to lower octaves | | |
| | | Automatic performance mode:<br>On the basis of adding a music library, the learning machine can automatically play songs and at least switch to play two songs. | | |
| | | Automatic performance mode:<br>• Display track number on the seven digital tubes: (5)<br>After entering automatic mode, the music library (with at least three or more songs in the library) can be flipped back and forth through buttons or switches, and the seven segment digital tube displays the content of the music library (including the number or abbreviation of the songs). | | |
| | | • During automatic performance, use lights to indicate the user's playing position and duration:<br>After pressing the button to confirm the track, the learning machine will start playing automatically. When a note appears, the light will be lit above the note, and after the note is played, the light will be turned off until the song ends. | | |
| | | Learning mode:<br>On the basis of guidance, improve the overall performance rating: for each note, determine the playing interval,<br>Based on the user's performance status, display the rating of the user's performance level on a seven segment digital tube or LED light | | |
| | | Learning mode:<br>On the basis of guidance, improve the overall performance rating: for each note, determine the playing interval,<br>Create accounts for different users and update their user ratings based on their performance records | | |
| | Additional creativity<br>(15 points) | Users can adjust the position of keys according to their usage habits: when the learning device enters adjustment mode, the device plays notes in order, such as do re mi. After selecting the note corresponding to 'do', press the confirm button, and the machine will play the next note, waiting for the user to select and confirm again. After completing all confirmations, the notes corresponding to the keys pressed by the user during practice will be consistent with the adjustment mode. [2] | | |
| | | For user performance records, you can choose whether to save them in the music library: enter recording mode, record the order and position of the keys pressed by the user, stop recording when the user presses the end key, and then automatically replay. After pressing the confirm button, the user saves it in the device and can replay it in automatic playback mode in the future (with options for deletion and overwrite) [2-4] | | |
| | | VGA displays more information about music to assist in guiding performance and adding fun: for example, using some graphics to indicate the timing of playing notes, displaying the song name instead of the number. [5-10] | | |
| | | The real-time update of ratings is more precise and reasonable: in the learning mode, real-time changes in ratings are provided based on the difference between the user's button time and the standard time. The scoring method will serve as the basis for evaluation. [2] | | |
| | | The rhythm of music varies more: in automatic mode and learning mode, the duration of each note can be inconsistent. [2] | | |
| | | If there are other creative ideas to be implemented, you can choose to demonstrate them in the defense [1-5] | | |
| | | **If the board test cannot be successfully conducted, simulation results and related interpretations need to be provided on-site, and the final score is 60% to 70% of the Project score** | | |