

Project Name: Tower of Hanoi

Team Number: 3

Overview

Our project is a mathematical puzzle game called Tower of Hanoi. This game involves three identical rods placed at the left, center, and right of the screen and a specified number of disks which are all of different sizes. In our version of the game, the number of disks must be between 3 and 7, inclusive. Initially, all of the disks are placed on the leftmost rod and arranged in descending order such that the smallest disk is on the top of the rod's stack and the largest disk is on the bottom of this stack. The objective of this game is to move the disks one at a time so that they eventually end up arranged in descending order on the rightmost rod. Only one disk can be moved at a time, and the disk being moved must be the topmost disk on one of the three rods. Additionally, a larger disk can never be placed on top of a smaller disk.

For each number of disks, the fewest possible number of moves needed to end the game is given by the formula

$$2^n - 1,$$

where n is the number of disks. At the end of the game, the player's number of moves is compared to the fewest possible number of moves.

Functional Requirements:

FR1: At the start of the game, the previous best scores for each level are loaded and displayed on the menu homepage.

FR2: the player selects the level to play between levels 1 through 5 (this corresponds to the number of disks to set up the game from 3 to 7, inclusive).

FR3: After the player selects the level, this corresponding number of disks (level 1 = 3 disks, level 2 = 4 disks, etc.) are arranged on the leftmost rod in descending order (smallest on top and largest on bottom).

A. This arrangement also occurs when the game is reset.

FR4: A disk is moved by selecting the disk's current rod and then selecting the rod to which the player would like to move the disk.

A. Only one disk can be moved at a time.

B. Only the topmost disk on a rod can be moved.

C. A larger disk can never be placed on top of a smaller disk. If the player attempts to perform this action, the disk remains on its current rod. Additionally, this action does not add to the player's total number of moves.

- D. In order to add a move to the player's total number of moves, a disk must be moved to one of the two rods that are not its current rod. Additionally, this disk cannot be placed on top of a smaller disk.

FR5: While all of the disks are not arranged on the rightmost rod in descending order (smallest on top and largest on bottom), the gameplay continues and the player continues to move disks one at a time.

FR6: The game continuously updates the player's total number of moves.

FR7: The difficulty of the game can be changed at any time, but this change also resets the game.

FR8: The game can be reset at any time.

FR9: If all of the disks are arranged on the rightmost rod in descending order (smallest on top and largest on bottom), the game is over.

FR10: Once the game is completed, the player's number of moves is compared to the fewest possible number of moves for the specified number of disks.

FR11: The player's number of moves is also compared to the best score stored for that level.

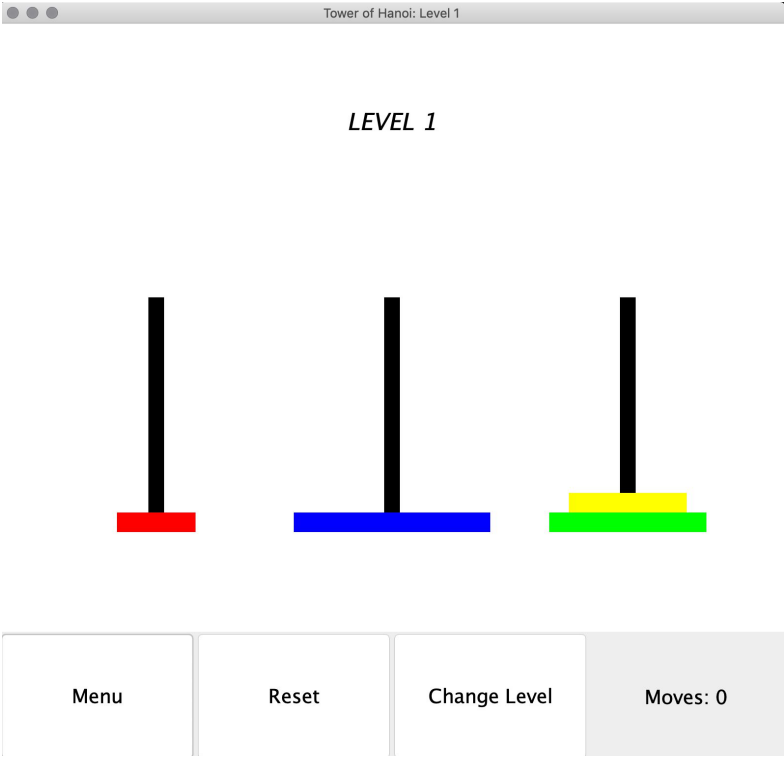
- A. If the number of moves is less than the best score, the player's score is stored as the new best score.
- B. Each level has a separate best score.

FR12: If the player's score is the best score after game completion, user input is taken for a name to store along with the score.

- A. If there is no input, a default name is stored with the score.
- B. When user input is submitted, the scoreboard is updated automatically.
- C. User input can only be taken once per best score.

FR13: Closing the game at any time exits the program.

User Interface Prototype:



User Interface Requirements:

UIR1: When the game is opened, a homepage is shown which displays the different level (initial number of disk) options, and FR2 is executed.

UIR2: After the user selects a level, FR3 is executed as the schematic of rods and appropriate number of disks are displayed.

UIR3: The user can move the topmost disk of a rod by clicking the disk's original rod and the desired destination rod. This executes FR4. Additionally, after the user clicks the original rod, this rod will be indicated by a different border color.

UIR4: The user can restart a game using the "Reset" button.

UIR5: The user can exit a game using the "Menu" button, which returns the user to the homepage.

UIR6: The user can change the level of difficulty by selecting the "Change Level" button which displays a dialog box with several (5) options, which when selected, restarts the game at the selected level.

UIR7: The number of moves is displayed and updated throughout gameplay.

UIR8: At game completion, gameplay is disabled.

UIR9: When the game is completed, the user has the option to play again, go to the next level of difficulty, or quit to the homepage.

UIR10: If the user has a best score, they may input a name to be stored alongside their score.

UIR11: The highest score for each level is displayed on the homepage with the name stored.

Appendix

https://en.wikipedia.org/wiki/Tower_of_Hanoi