Sokoban Game Manual

Requirements

Number of Players: 1+ Players
Age: 10+ Years
Software: Ripes (Running RISC-V Assembly)

Implemented Features

Multiplayer
Timer

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CSC258 Assembly Project
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Welcome Excerpt

*Welcome to **SOKOBAN**!*

It is the year 2004 and you are an adventurer exploring a jungle. As you are climbing a tree, you start hearing a whistling noise in the distance continually getting louder, followed by pitch darkness: You were knocked unconscious.

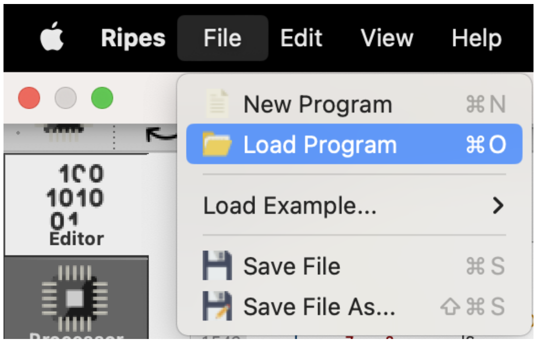
Without knowing how much time has passed, you finally wake up and take off what appears to be a blindfold made of sticks and cotton. You find yourself sitting on a wet, mossy floor in a dark room surrounded by walls. You realize that you have been kidnapped and are now trapped in a dark dungeon! Suddenly, a blue box and a green light emerge from the floor and illuminate the room. Your task is simple; push the box over the green target to survive…

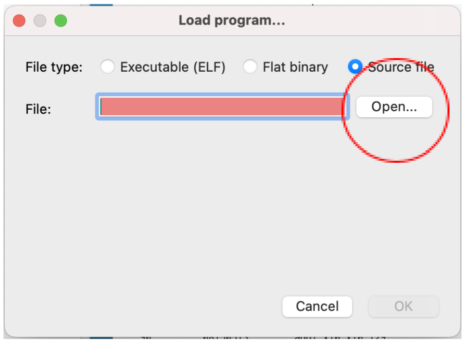
"Not so fast! Of course, there's a catch," an eerie voice says from the ceiling of the dungeon. You notice a timer begins to count down from 10 to 1 and you definitely do not want to know what happens when time is up. Do you have what it takes to solve the puzzle and avoid being stuck in the dungeon forever?

Sokoban is a game all about **strategy** and **quick thinking**. To summarize, the object of the game is to have your player push a box onto a target within the 10 second time limit. For a real challenge, it is encouraged to compete amongst some friends! This manual will detail everything you need to know about setting up and playing Sokoban in any way you choose, whether it is at a family game night, a party with friends, or a simple solo session!

Game Setup (Ripes)

First, open Ripes and click on **File** > **Load Program**. Select the "**Source File**" option, and click the "**Open…**" button. Then, navigate to the sokoban.s file on your computer.

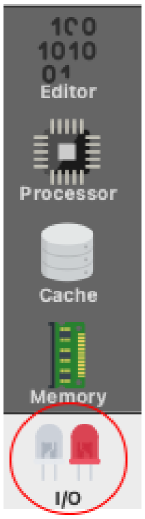


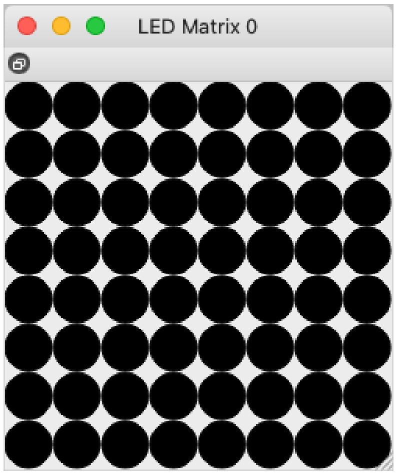


File type: ○ Executable (ELF) ○ Flat binary ● Source file

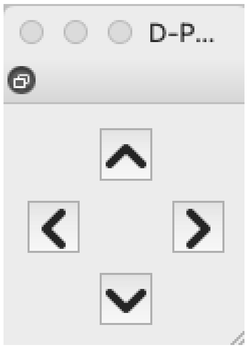
File:

Then, click the "**I/O**" button in the left sidebar. Here, you'll find your LED Matrix (this is your Game Board) and Control Pad (referred to as the Directional Pad, or D-Pad). On the right side of the screen, you click on the "**LED Matrix 0**" button. Ensure that the "**Height**" and "**Weight**" fields are set to 8 and adjust the "**LED size**" as you see fit to make the Game Board bigger and smaller.

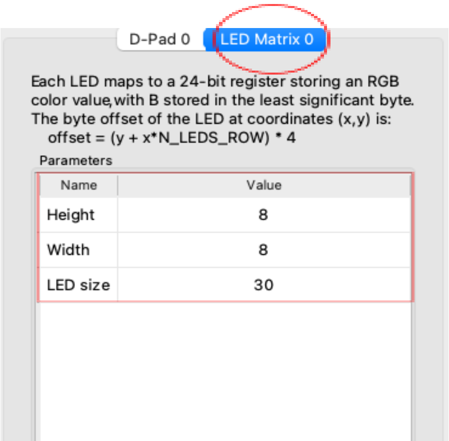




LED Matrix (Game Board)



Directional Pad (D-Pad)

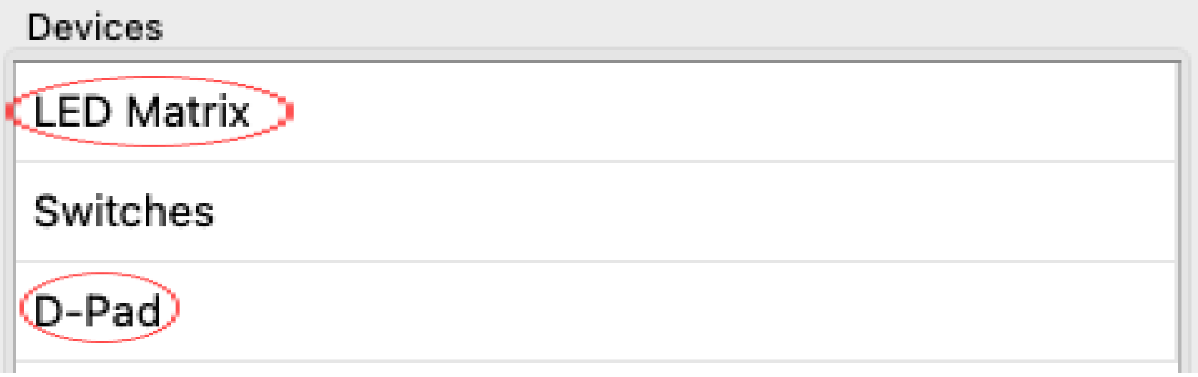


Each LED maps to a 24-bit register storing an RGB color value, with B stored in the least significant byte. The byte offset of the LED at coordinates (x,y) is:
offset = (y + x*N_LEDS_ROW) * 4

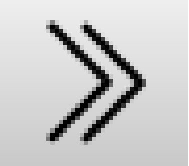
Parameters

Name	Value
Height	8
Width	8
LED size	30

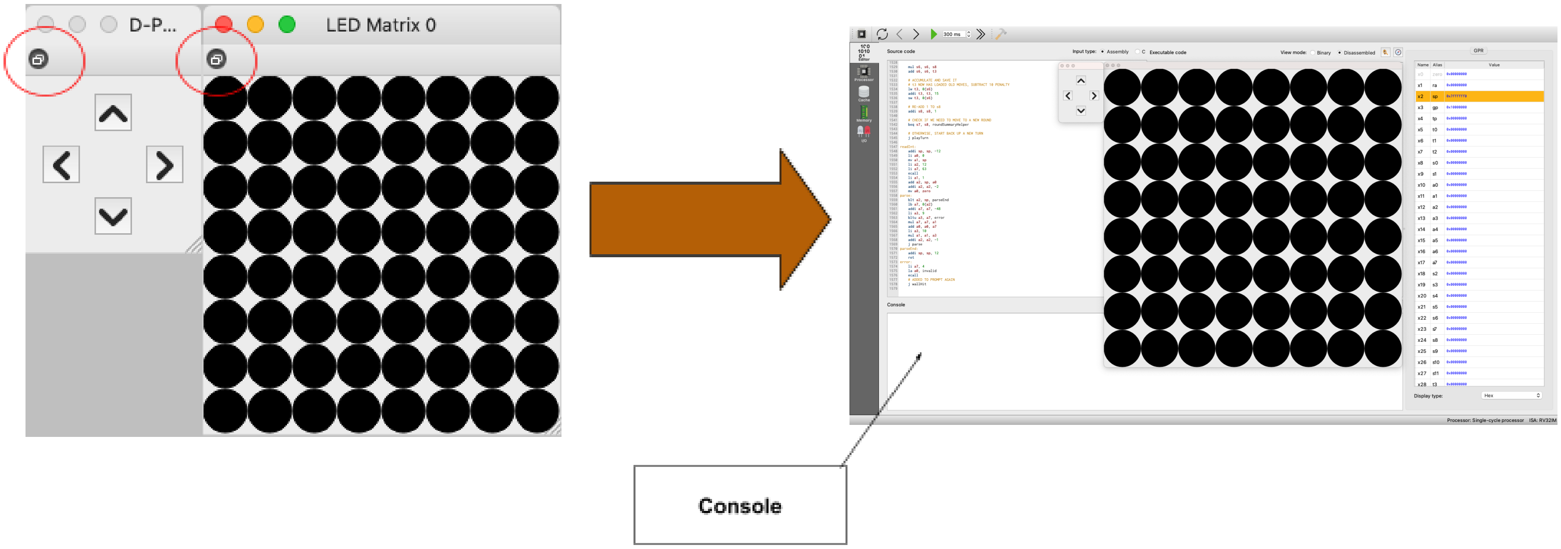
Note that if you do not see the LED Game Board or the D-Pad, be sure to click the "**LED Matrix**" button and "**D-Pad**" from the left **Devices** panel to make them appear.



To put these onto the editor screen where you will be able to see the game board *and* D-pad in the same window as the console, click on the picture-in-picture buttons on each window respectively and navigate back to the "**Editor**" tab via the left side sidebar. To start a game, click on the "**Fast Execution**" button at the top of the screen.



Fast Execution



Upon clicking the "**Fast Execution**" button, the program will start to run! You are now ready to play Sokoban. Continue reading to learn more about the details of how to configure the game once the program begins running.

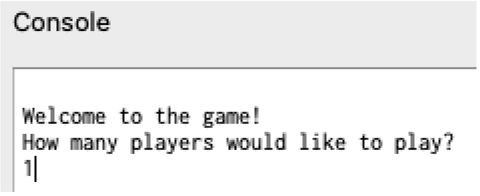
Game Setup (Console)

This version of Sokoban involves multiple rounds, playable by multiple players! Upon starting up the game using the "**Fast Execution**" button, you will be prompted in the **Console** to input how many players will be playing the game.

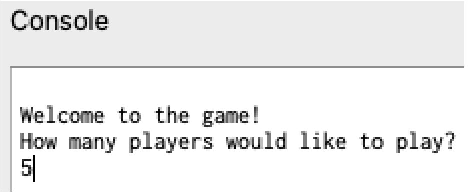
If you would like to play **Single Player**, simply type **1** and click the **enter** button on your keyboard. Otherwise, if you would like to play the turn-based **Multiplayer**, type the number of players that will be playing and click the **enter** button on your keyboard.

Note that the program will only accept a **whole number input (excluding 0)**. If you input anything else here, the **Console** will indicate that the input is invalid and will restart the game. If this happens, do not worry, you may simply retry!

○

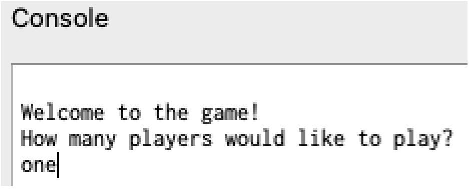


```
Welcome to the game!
How many players would like to play?
1
```

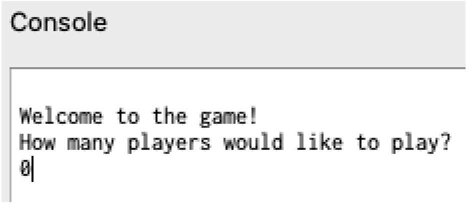


```
Welcome to the game!
How many players would like to play?
5
```

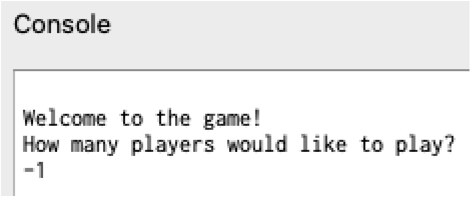
🚫



```
Welcome to the game!
How many players would like to play?
one
```



```
Welcome to the game!
How many players would like to play?
0
```



```
Welcome to the game!
How many players would like to play?
-1
```

Similarly, the **Console** will prompt you again to input the number of rounds you would like to play. Simply type in the number of rounds to be played and click enter on the keyboard. The concept of turns and rounds will be expanded upon in the How to Play section, so it is recommended to read *all* sections of this manual before starting the game.

Again, note that the program will only accept a **whole number input (excluding 0)**. If you input anything else here, the **Console** will indicate that the input is invalid and will restart the game. If this happens, do not worry, you may simply retry!

Once the number of players and rounds are entered, you are ready to play. When this occurs, the game will form the first randomized puzzle, or configuration of placing the player, target, and box on the **Game Board**. Make sure all players are ready to play before starting the game as the timer will start ticking for Player 1 immediately after starting the game! Read the next section to learn how to play using the **Game Board** and **D-Pad**.

How to Play

Game Key

The 8x8 game board represents the dungeon game area, where the black circles arranged in the middle as a 7x7 square are all fair game to play on and are each referred to as playable areas. The surrounding yellow circles represent the walls of the dungeon. As indicated in the Welcome Excerpt, the target is depicted using the green circle and the box with the blue circle. A player—regardless of whether it is Player 1, Player 2, or any other numbered player—is represented by the red circle. The full key is as follows…

🟡	⚫	🟢	🔵	🔴
WALL	**PLAYABLE AREA**	**TARGET**	**BOX**	**PLAYER**

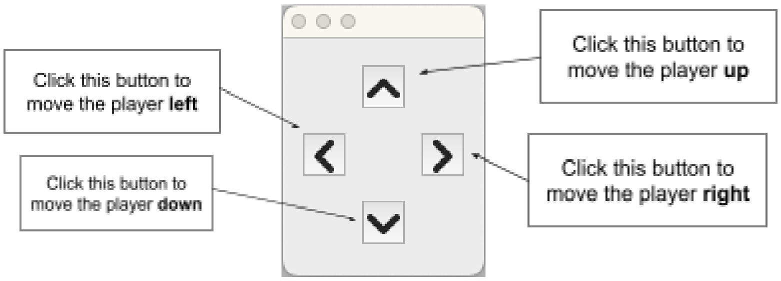
Note that at all times in the game, the target, box, and player may *only* occupy exactly *one* of the playable circles, thereby replacing the black circle with their respective colored circle. Also, the player may "stand" on the target at some points in the game. In this situation, the player and the target both occupy *one* playable area, denoted as the orange circle. Once the player is no longer occupying the same playable area as the target, the red player and green target will each occupy their own individual playable areas as usual.

🟠

PLAYER ON TARGET

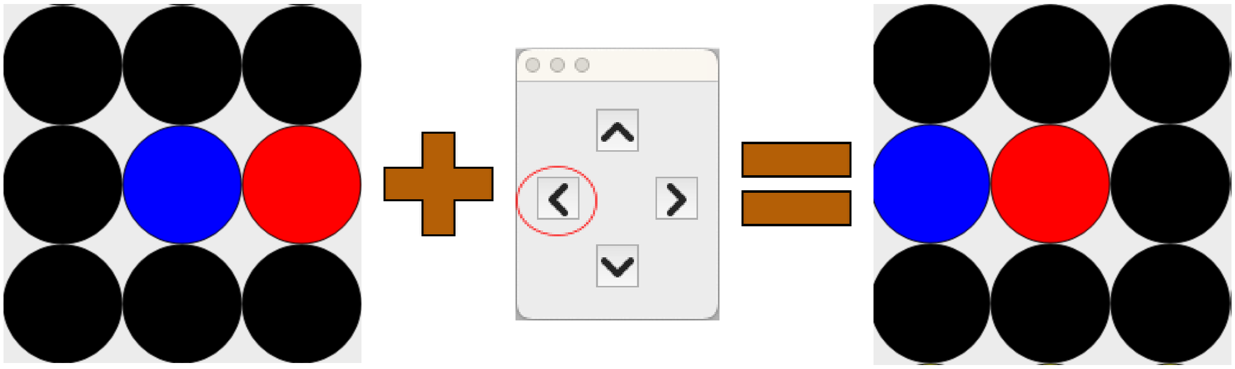
Making a Move

But, what does a "**move**" actually mean? A move occurs when a player's red circle traverses from one playable area to light up another, indicating the player is now located on the next playable area after the move has been made. A move can only be made to go up, down, left, or right (*not diagonally*). In particular, a move can only be made to the *adjacent* (one circle at a time) playable area to the left, right, top, or bottom of the current playable area the player is located on (indicated with the red circle). Such moves are made by clicking the respective buttons on the D-Pad, as indicated below…


Click this button to move the player up
Click this button to move the player left
Click this button to move the player right
Click this button to move the player down

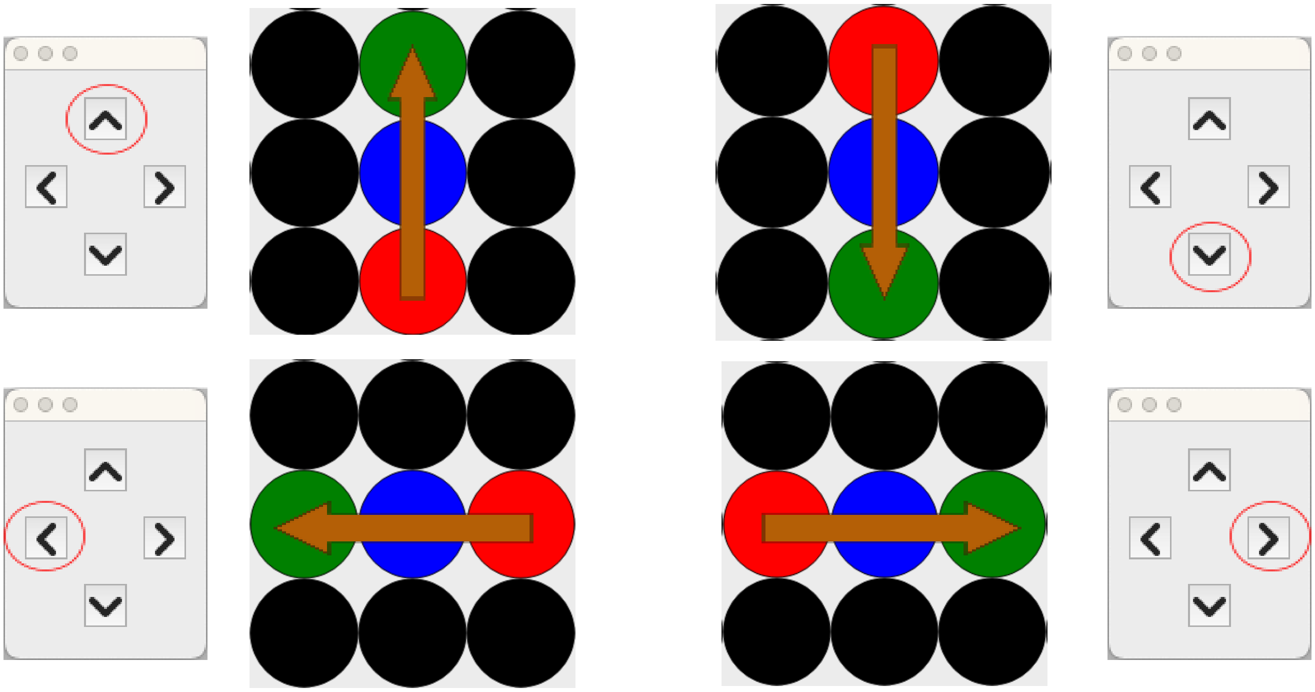
Pushing the Box

A player may “**push**” the box simply by making a move in the direction of an adjacent box. For instance, if there is a box located on the playable area to the left of the player, the player may only push the box by one playable area to the left. This thereby moves the player into the playable area where the box previously was prior to the push. An illustration of this can be found below…

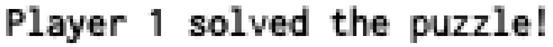


Solving the Puzzle

A player may make an unlimited number of moves to “**solve**” the puzzle, provided they complete the puzzle within the allotted 10 second time limit. A puzzle is deemed solved when the player pushes the box onto the target. In other words, the box must be pushed in a manner such that it occupies the same playable area as the target in order to solve the puzzle. The box may be pushed onto the target from any direction. The figure below visually demonstrates the different ways a puzzle can be solved…



If a player has solved the puzzle, the console will provide a prompt that they were successful in doing so.



```
Player 1 solved the puzzle!
```

Puzzle solved prompt

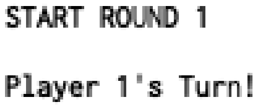
Playing Rounds and Turns

A "**turn**" of the game is when one player attempts to solve a puzzle within the 10 second time limit. A "**round**" is a set of turns where each player plays exactly one turn on the same puzzle. In practice, each player gets exactly one turn per round, equating to one opportunity to solve that round's puzzle.

For instance, in a game of two players and two rounds (**Multiplayer**), in the first round Player 1 plays their turn, followed by Player 2 on the same puzzle. In the second round, Player 1 will start on a new puzzle, followed by Player 2 on the same puzzle.

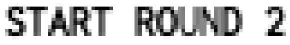
If the game is being played in **Single Player**, a turn and a round simply begin and end at the same time as there is only one player playing the game.

The first turn of the first round starts as soon as the number of rounds is entered upon starting up the game. The console will prompt the current round number—starting from Round 1 and ending at the round number inputted—at the start of every round, as follows…



```
START ROUND 1

Player 1's Turn!
```

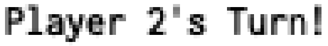
The first turn of the first round prompt



```
START ROUND 2
```

The start of the subsequent round prompt

Any one player's subsequent turn starts immediately at the end of the previous player's turn. The turns of a round will always be conducted in numerical order, starting from Player 1 to the final player's number (the inputted number at the start of the game). Be sure to remember which player is assigned to which number! The console will prompt the current player to play at the start of every turn, as follows…

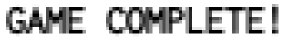


```
Player 2's Turn!
```

The start of the subsequent turn prompt

A player’s turn ends when they either solve the puzzle, or they run out of time to complete the puzzle (this is further expanded on in the next subsection, Running Out of Time).

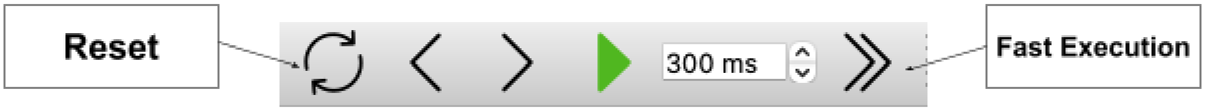
A round ends when the final player’s turn ends, starting up the next round with a new randomized puzzle configuration if the current round is not the final round. For instance, if there are 5 players in the game, a round will end at the end of Player 5’s turn. At the end of the final requested round, the console will inform all players that the game has been completed.



GAME COMPLETE!

Game complete prompt

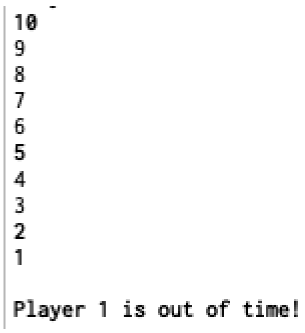
At this point, clicking buttons on the D-Pad will have no effect and the game is over. To restart, simply click the **Reset** button, followed by the **Fast Execution** button.



Running Out of Time

This version of Sokoban comes with a 10 second timer, as alluded to in the Welcome Excerpt. The timer begins at the start of every player’s turn. The timer will count down from 10 to 1 in one second intervals.

If the player does not complete the puzzle in time, they will be forced to forfeit their turn of the current round, immediately prompting the start of the next player’s turn. The console will prompt that the player has run out of time, and thus was unsuccessful in solving the puzzle of the round in time during their turn.



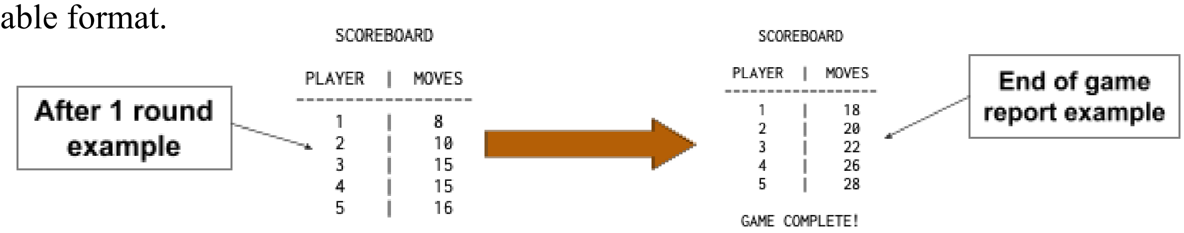
```
10
9
8
7
6
5
4
3
2
1

Player 1 is out of time!
```

Example of console displaying the timer, along with a player running out of time

Keeping Score

If a player is able to solve the puzzle within the 10 second time limit, the number of moves they made on that turn is added to that player's cumulative score.

The **cumulative score** is the sum of *all* moves a player has made across *all* turns the player has played up until the current moment in the game. The updated **scoreboard** will appear at the end of each round, displaying each player's cumulative score in a combined table format.



```
     SCOREBOARD

PLAYER  |  MOVES
-------------------
  1     |   8
  2     |   10
  3     |   15
  4     |   15
  5     |   16
```

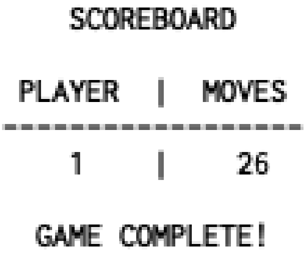
```
     SCOREBOARD

PLAYER  |  MOVES
-------------------
  1     |   18
  2     |   20
  3     |   22
  4     |   26
  5     |   28

  GAME COMPLETE!
```

If a player runs out of time when attempting to solve the puzzle, they will be subject to a *15-move penalty*. This means that 15 moves will be added to their accumulated score at the end of their turn of the current round and any moves made during the turn will not be counted.

Winning the Game

The game is over when the final player completes their final turn of the last round. A player has won the game if at the end of the game (i.e. Round 5 if the player requested to play 5 rounds) they have the *least* number of total moves compared to the rest of the players. The player with the second-*least* number of moves will place in second, followed by the player with the third-*least* number of moves in third, and so on. The example from the previous subsection illustrates a scenario in which Player 1 has won the game, followed by Player 2 in second, Player 3 in third, Player 4 in fourth, and Player 5 in fifth.

Note that if the game is being played in **Single Player**, the player will be competing against themselves to get the lowest number of moves they can. This is similar to a time trial mode in racing games.



```
     SCOREBOARD

PLAYER  |  MOVES
-------------------
  1     |   26

  GAME COMPLETE!
```

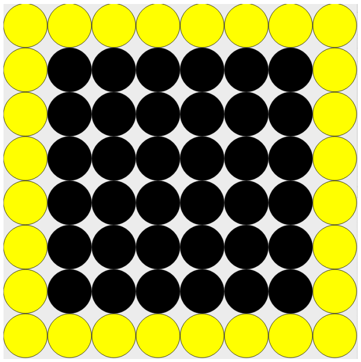
Single Player Mode Complete Game Example

The scoring system from the previous subsection ensures that if the player plays moves too fast and recklessly, they may make some extra moves, raising their cumulative score. On the other hand, if the player plays too slow and calculated, the game will penalize the player by adding the 15-move penalty. This means that winning the game is all about balancing one's reactions and instincts with strategy!

Restarting the Game

If a player wishes to restart the game prior to the completion of all the requested rounds of play, the player may move their player into a wall. This is referred to as "**hitting**" a wall.

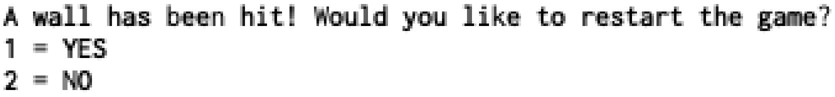
Upon doing so, the player, box, and target will *disappear*, leaving the Game Board with the 7x7 playable area space surrounded by the walls. Do not be alarmed, this simply means that the game is paused and waiting for the player's confirmation to restart the game! At this time, no player may click any buttons on the **D-Pad** as they will not be registered because the game is paused.



Game Board awaiting restart confirmation

The **console** will prompt the player to type **1** or type **2** and press the enter button on the keyboard.

1. If **1** is entered, the game will restart from the very beginning, thereby re-requesting the number of players and rounds again as done when the **Fast Execution** button was first pressed to run the game.
2. Otherwise, if a **2** is entered, the current game will continue at the exact point prior to the player hitting the wall. The timer will also resume at the number of seconds remaining that it left off at the time of hitting the wall.



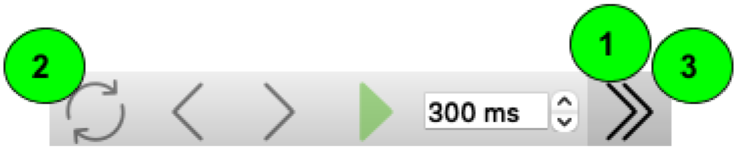
```
A wall has been hit! Would you like to restart the game?
1 = YES
2 = NO
```

Restart Game Confirmation Prompt

Note that triggering a restart can also occur when the box is pushed into a wall. If the box hits the wall as a result of a player’s push, the same process and rules apply when restarting a game.

Troubleshooting

If the game stops running or there is an issue at any point and the **Fast Execution** button is still illuminated, simply click the **Fast Execution** button and then click the **Reset** button, followed by the **Fast Execution** button again.



Otherwise, if the Fast Execution button is not illuminated, simply click the **Reset** button, followed by the **Fast Execution** button. Note that this brief process will also need to be done to restart the game once it is complete.