

# Computing Machinery II

## Assignment 4

### Maze Game: SNES Controller and Frame Buffer Programming

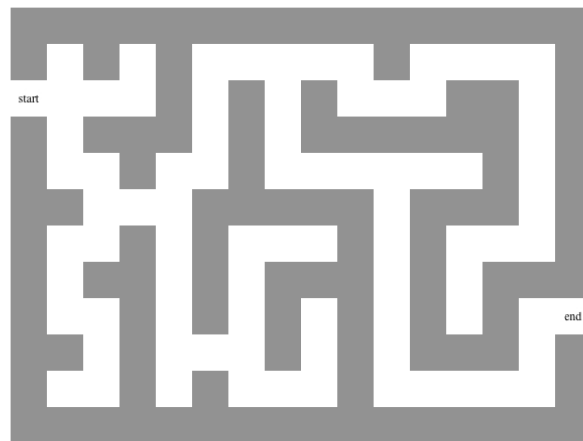
Create a program for the Raspberry Pi that presents a maze on the HDMI monitor. Use a dark color for the walls of the maze, a lighter color for the pathways through the maze, and red for the player that moves through the maze on the pathways. When the player reaches the exit of the maze, redisplay the player in green to indicate that the maze has been solved and the game is over.

The maze should be constructed on a grid with 12 rows and 16 columns, where each element of the grid is a square that is 64 x 64 pixels in size. Use a display resolution of 1024 x 768 pixels, where each pixel is a 32-bit integer containing the RGB encoding for the color. Use these squares to construct the walls and pathways of the maze, and to represent the player as it moves through the maze.

You should use a two-dimensional array as the data structure to represent the maze. For example, in the following, 0 represents a pathway, 1 a wall, 2 the entrance, and 3 the exit:

```
int maze[12][16] = {
    {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
    {1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1},
    {2, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1},
    {1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1},
    {1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1},
    {1, 1, 0, 0, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1},
    {1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1},
    {1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1},
    {1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 3},
    {1, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1},
    {1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1},
    {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1}};
```

This could be displayed as follows:



Your program will use the SNES controller connected to the Raspberry Pi to control the movement of the player through the maze. When your program starts up, it will display the maze, but not the position of the player. When the user presses the controller start button, show the player in red in the starting position. Use the joystick arrow buttons to move the player one position to the left, right, up, or down. The player can only move on the pathways, and is not allowed to go through any walls or leave the playing area. Display the

player in red as it moves through the maze, and be sure to recolor the pathway its original color once the player has moved onto a new position. When the player reaches the exit of the maze, display the player using a green color to indicate that the game is over. At this point, the player can press the start button to restart the game.

You may write your program in C or in A64 assembly language, or a combination of both. You can freely use the following files located on D2L as part of your code base: `gpio.h`, `link.ld`, `mailbox.c`, `mailbox.h`, `Makefile`, `start.s`, `systimer.c`, `systimer.h`, `uart.c`, and `uart.h`.

**New Skills Needed for this Assignment:**

- Ability to read data from the SNES controller
- Ability to do frame buffer programming

**Submit the following on D2L:**

1. All files needed to compile your program. This will include the files listed above, plus any custom code that you have created.

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### Assignment 4 Grading

Student: \_\_\_\_\_

Responds to 5 SNES button presses	5	_____	
Maze displayed correctly (walls, pathways)	4	_____	
Correct player movement (4 directions, stays inbounds, stays on pathway)	6	_____	
Player movement properly displayed	2	_____	
End of game recognized/displayed	2	_____	
Game restart works properly	2	_____	
Code formatting and documentation	2	_____	
Design quality	2	_____	
<b>Total</b>	<b>25</b>	_____	_____ %