

CS 200: Computer Organization

Project 9: Maze Generator

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Overview

Purpose

This project required us to write a program in MIPS assembly language that recursively generates a maze.

Approach

I followed the project guide and looked through the skeleton Assembly code provided to find the TO DO sections. Changing the header was quick and easy. Then I put together an algorithm that would return a random number. This number would be used as a seed for the next time the routine is called. This went under the Rand function and I had already built this function for Project 7 but I had to refactor the code to get it to work for this project. After this, I fleshed out the routine for XYToIndex, which converts a two-dimensional pair into a single-dimensional index. The next algorithm was IsInBounds, which checked to see whether the X and Y values were within the constraints of the grid. For this part, I was not sure how to return true or false values and ended up choosing to return 0 for True and 1 for False. The last function I wrote out was PrintGrid. This was by far the most satisfying one since I got to see the grid generate and building the rest of the functions had been highly test-driven. I wrote tests for each function to ensure that they worked together correctly and this took up the brunt of my time on this project. I think this practice produces code that is more bullet-proof.

Sample Output

The screenshot shows the Mars IDE with the following components:

- Menu Bar:** File, Edit, Run, Settings, Tools, Help
- Toolbar:** Icons for file operations (open, save, print, etc.) and development tools (debugger, etc.).
- Tab Bar:** Shows open files: maze.asm, bubblesort.asm, mips1 (1).asm, mazetest.asm, and Project9.s. The active file is bubblesort.asm.
- Code Editor:** Displays assembly code for bubbleSort.asm. The code includes comments in green and assembly instructions in black. It defines a grid, a seed, and functions for grid operations and random number generation.
- Status Bar:** Shows "Line: 421 Column: 3" and a checkbox for "Show Line Numbers" which is checked.
- Output Window:** At the bottom, it has tabs for "Mars Messages" and "Run I/O". The "Run I/O" tab is active, showing a large number of empty lines, indicating that the program has not yet been executed.

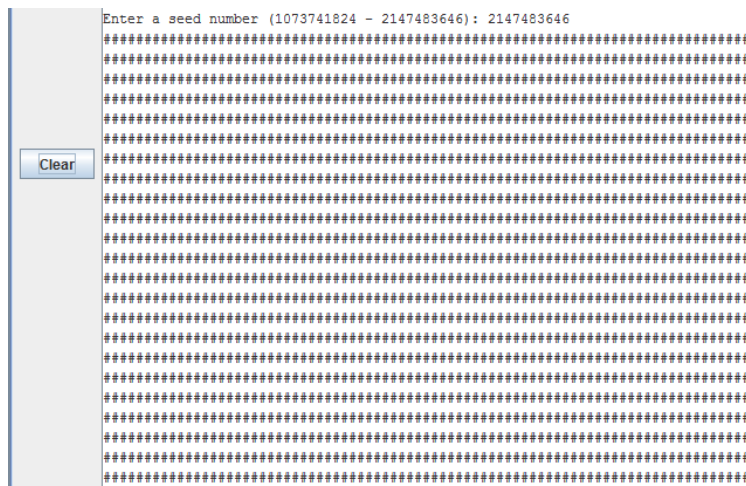


Figure 1: Sample Output

Conclusion

This project was a great exercise in test-driven programming in assembly. This project was open ended as to what the final output would be so I had to come up with tests for each function to ensure correctness of the implementation. The functions flowed together and the numbers generated were within bounds so my code worked. I am excited to write the Visit function out and work on the next phase of the project.

I also got more practice in writing branches and differentiating between la, li, lw and sw. I think the key to learning Assembly is right there in the in-depth differences between functions. Learning more about each function and how it works with memory really deepened my appreciation for the language.

References

MIPS Architecture and Assembly Language

<http://logos.cs.uic.edu/366/notes/mips%20quick%20tutorial.htm>

Understanding the Stack

<http://www.cs.umd.edu/class/sum2003/cmsc311/Notes/Mips/stack.html>