

Team 23: Hardware Warriors.
New Mexico SuperComputing Challenge .
Final Report
06 April 2022

Team Number: 23

School Name: Justice Code International

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Maze Solving for Beginners

Executive Summary

Introduction

We all enjoy sitting around and playing brain games from time to time. Games like Sudoku, crossword puzzles, and concentration can give us the mental breaks that we need. One of the most popular brain games is the maze. A maze can be defined as a network of paths designed as a puzzle in which one must find a way, typically from an entrance to a goal. There are two types of mazes which are multicursal and unicursal. Multicursal mazes refer to those that contain multiple paths to the center and the outside through which the solver must find a route. Unicursal mazes, also referred to as labyrinths, are those that will contain a non-branching singular path which will ultimately lead to the center. The term "labyrinth" is generally

synonymous with "maze", but can also imply specifically a unicursal pattern. The pathways and walls in a maze are typically fixed, but puzzles in which the walls and paths can change during the game are also categorized as mazes or tour puzzles.

Problem Statement

Maze solving is the act of finding a route through the maze from the start to finish. There are several methods that can be used to solve mazes. Certain methods are designed to be used inside the maze by a traveler with no prior knowledge of the maze. Others are designed to be used by a person or computer program that can see the whole maze at once. Each methodology can be used on different types of mazes, but there is no guarantee that they will work. In this project, we seek to use Starlogo Nova to create a maze solving algorithm that is able to combine multiple maze solving methodologies to solve any maze or labyrinth encountered.

Computational Model

- Selection - Methods evaluated were the Wall Follower Method; the Trémaux Method; and the Bread Crumb. We determined that a Wall Follower algorithm would be best suited for our project.
- Modification - We were able to meet with somebody who had worked on maze codes in the past and were able to get inspiration from his code to use in ours.
- Visualization - This maze we selected is a decent sized maze and didn't really expect too much.

- Limitations - Some of the limitations we were expecting was for turtles to complete the maze without using any arrow keys, or a keybind to move the turtle..

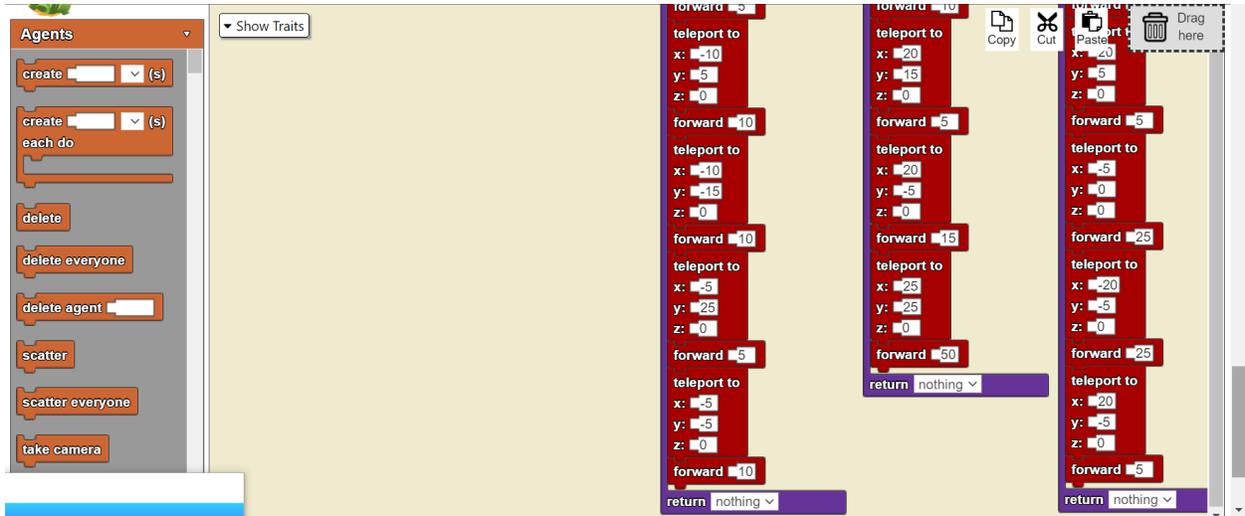
Problem Solving : The Finished Maze Search Program

To make it easier for us we assumed that our maze was divided up into “squares.” Each square of the maze was either open or occupied by a section of wall. The turtle could only pass through the open squares of the maze. If the turtle bumped into a wall it must try a different direction. The turtle would need to require a systematic procedure to find its way out of the maze

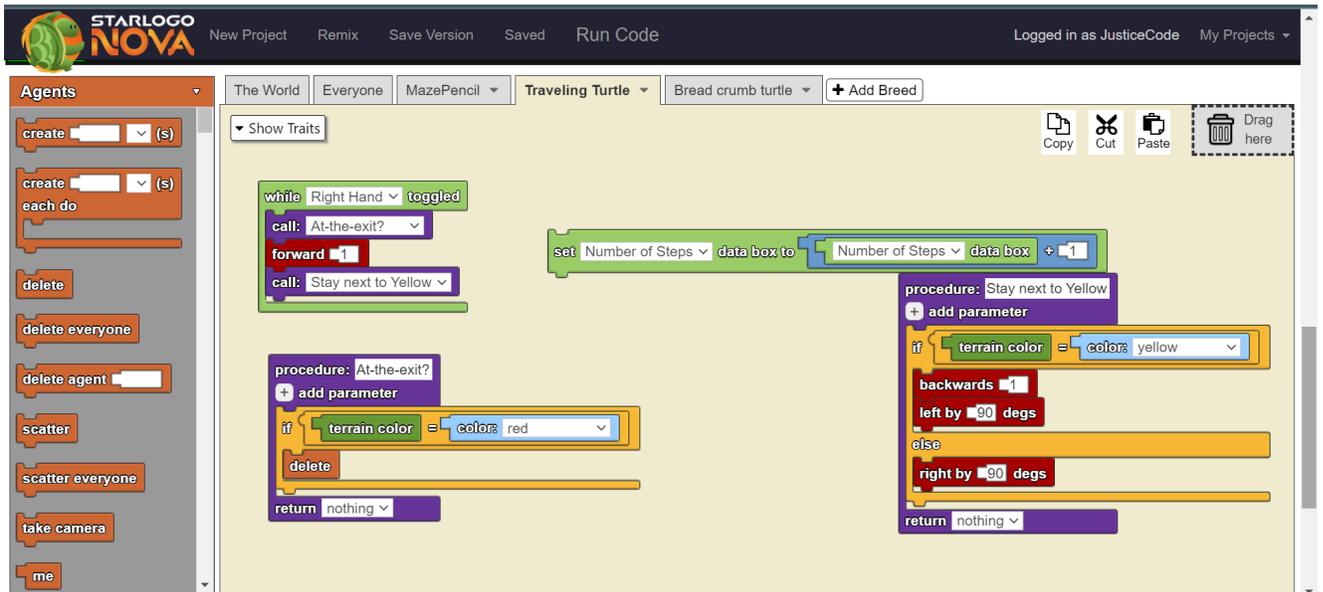
Starlogo Nova - Maze Pencil coding

The screenshot displays the StarLogo Nova coding environment. The main workspace shows a 'Traveling Turtle' agent and a 'Bread crumb turtle' agent. The code is organized into several procedures:

- when Draw Maze pushed:** This procedure triggers the drawing process. It includes:
 - pen down
 - call: Draw Maze Exit
 - call: Horizontal Lines 1
 - call: Horizontal Lines 2
 - right by 90 degs
 - call: Vertical Lines 1
 - call: Vertical Lines 2
 - delete
- procedure: Draw Maze Exit:**
 - add parameter
 - set my color to color: red
 - teleport to (x: 1, y: -25, z: 0)
 - forward 3
 - set my color to color: yellow
 - return nothing
- procedure: Vertical Lines 1:**
 - teleport to (x: -25, y: 25, z: 0)
 - forward 50
 - teleport to (x: -20, y: -20, z: 0)
 - forward 10
 - teleport to (x: -20, y: 5, z: 0)
 - forward 15
 - teleport to (x: -20, y: -15, z: 0)
 - forward 5
- procedure: Vertical Lines 2:**
 - teleport to (x: 0, y: -20, z: 0)
 - forward 5
 - teleport to (x: -10, y: -10, z: 0)
 - forward 10
 - teleport to (x: -5, y: -5, z: 0)
 - forward 5
 - teleport to (x: -5, y: -20, z: 0)
 - forward 5
- procedure: Horizontal:**
 - teleport to (x: -25, y: 0, z: 0)
 - forward 20
 - teleport to (x: 0, y: 25, z: 0)
 - forward 25
 - teleport to (x: -20, y: 0, z: 0)
 - forward 5
 - teleport to (x: -5, y: -20, z: 0)
 - forward 15
 - teleport to (x: -15, y: -15, z: 0)
 - forward 10
 - teleport to (x: -10, y: -10, z: 0)
 - forward 15
 - teleport to (x: -15, y: -10, z: 0)
 - forward 5
 - teleport to (x: -20, y: -10, z: 0)
 - forward 25



Starlogo Nova - Traveling Turtle coding



Starlogo Nova - Breadcrumb Turtle coding

The screenshot displays the Starlogo Nova web interface. At the top, there is a navigation bar with the Starlogo Nova logo and buttons for 'New Project', 'Remix', 'Save Version', 'Saved', and 'Run Code'. The user is logged in as 'JusticeCode'. The main workspace shows a 'Bread crumb turtle' with a code block containing a 'while' loop. The code block starts with 'while Right Hand toggled', followed by 'forward 1', an 'if' statement 'if terrain color = colors yellow', 'right by 90 degs', 'stamp grid colors brown', another 'if' statement 'if terrain color = colors red', and finally 'delete'. The left sidebar shows 'Agents' with various actions like 'create', 'delete', 'scatter', and 'take camera'.

Conclusions

Results - The algorithm performed as expected. The turtles were able to successfully navigate the maze.

Future Work - Our future work is to implement the algorithm on a much larger maze which requires more complex coding. We will most likely use a five-by-five maze. We are excited to make people who do not understand mazes more able to solve them.

Acknowledgements

Caia Brown

Rebecca Campbell

Mary Sagartz

Ryan Palmer

Starlogo Nova

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