Lab 6, CSC 203
Depth First Search
Due: 11/28/23

This lab explores recursion through the implementation of a depth-first search on a two-dimensional grid (a simple graph).

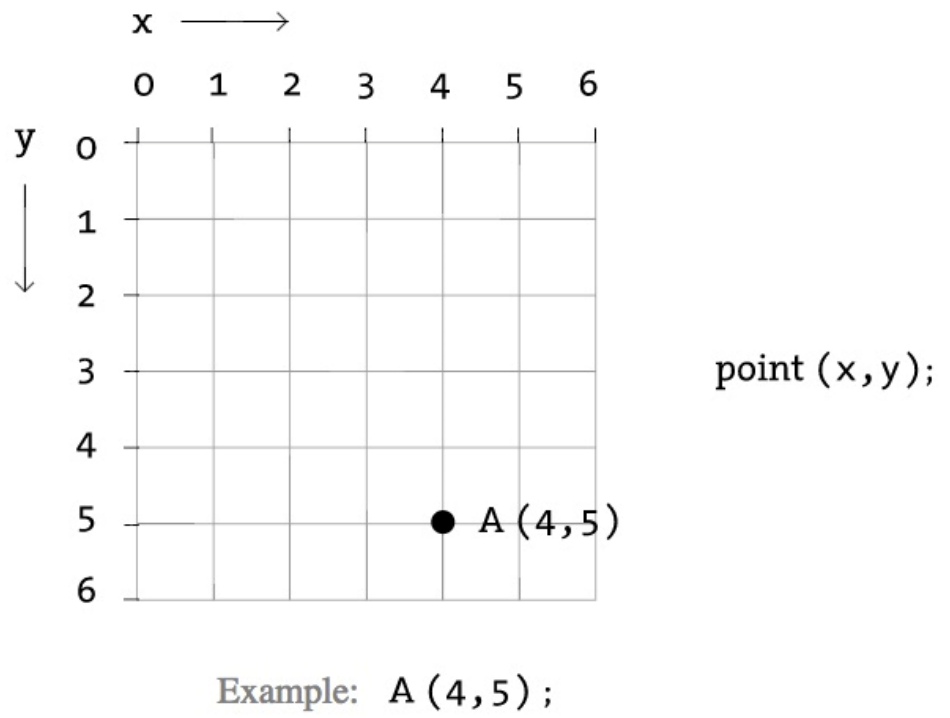
Objectives

- To implement depth first search
- Practice thinking about trajectory planning on a 2D grid structure

Overview

Get the base code from Canvas. (Point.java and PathingMain.java)

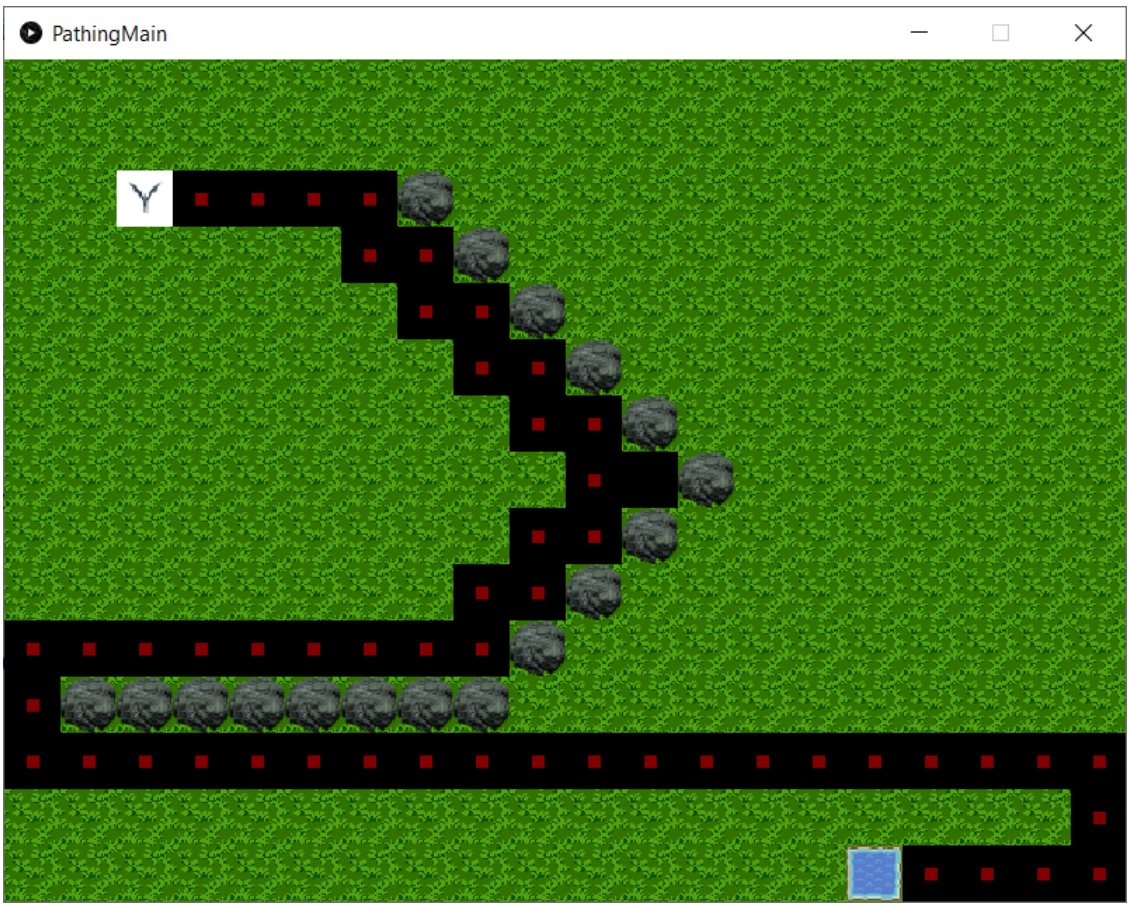
Begin with the base code. Note that this code represents the world as a 2D occupancy grid. Note that Processing, the tool we will use for visual display of the 'world' and 'path', uses a 2D coordinate system (sometimes used to represent images), where {0, 0} is the upper left corner. This means that as the y value of a coordinate increases, the point is *lower* in the screen/world. This image shows the general structure.



The project we have been working with this quarter is using a similar data structure. This code is just a very simplified version of the virtual world.

Your code will need to use the **Processing jar** (You can grab the file from Project 1 given files). You will need to make sure the .jar for Processing is included in your CLASSPATH. For implementation if you want to use BinaryTree the BinaryTree.java is offered.

Test to make sure the base code works for you. When your program starts, it should look something like this - where the goal is for the wyvern to find a valid path to the water, only traversing the grass and not the rock obstacles:



Getting started - Background

Open the provided Java file and read through the code. This code is written in a very simple style to follow to the requirements of and to illustrate some features of the Processing library. You will adapt this code to the project in an assignment.
Use of the Processing library begins with the definition of a class that extends PApplet and that includes a main method like the following to create an applet using the specified class.

```
  public static void main(String[] args)
  {
    PApplet.main("PathingMain");
  }
```

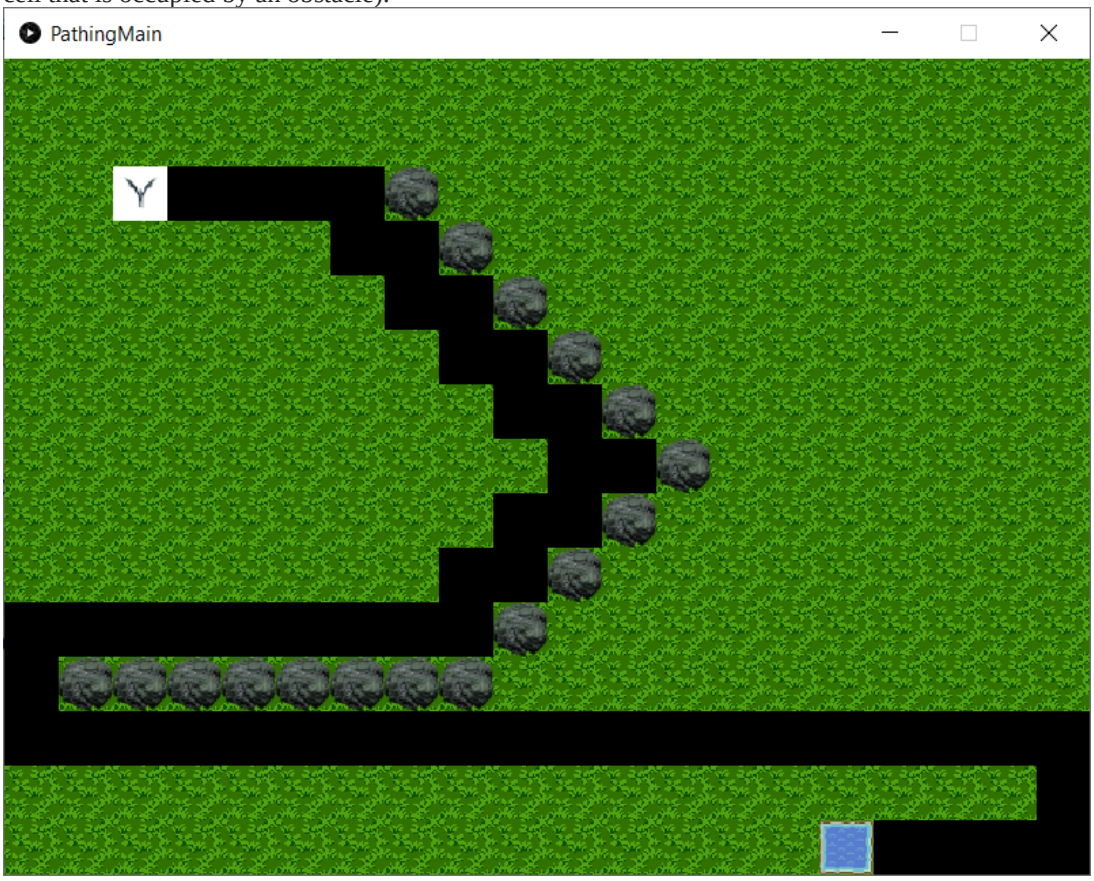
This class overrides two important methods: setup and draw. The setup method is run once when the, in Processing terminology, "sketch" is created. The draw method is called repeatedly (by Processing) and will contain the control logic of the "sketch".
You will also see that the code includes a two-dimensional array to represent the "world". This grid should be 20x15. For this lab, you will use this grid to store background tiles, obstacle tiles, and a goal tile. The code uses

integer values to represent these different types of tiles, via an enum, specifically:
private static enum GridValues { BACKGROUND, OBSTACLE, GOAL, SEARCHED }

There is a keyPressed() method that can be used to activate your depth-first search. As it stands, in the base code, the pathing only traverses one neighbor, which you want to replace. The direction to the neighbor is based on **RDLU** (right, down, left, and up). The code is there to give you a good example of working with the grid data structure.

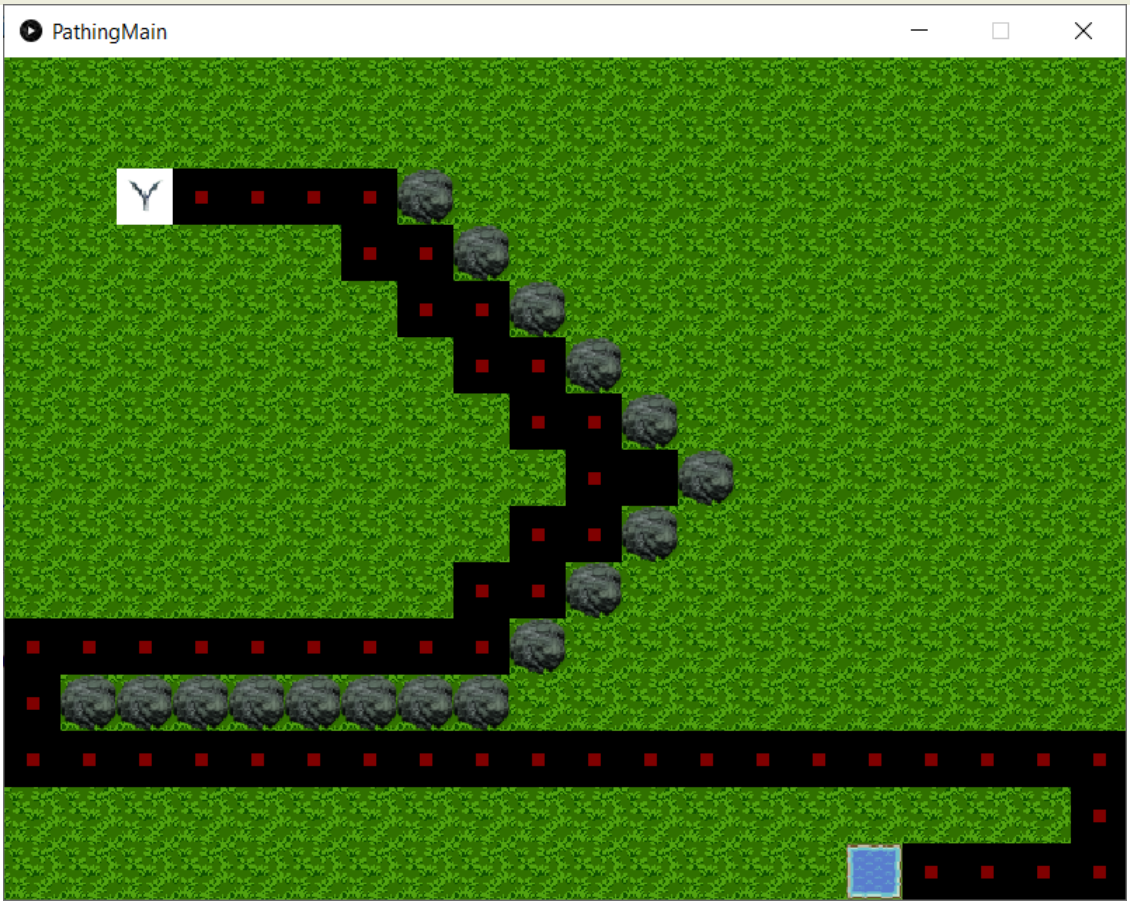
Step 1

At this point you need to implement depth first search. Note you can visit the neighboring nodes in whichever order you prefer. Perhaps try visiting in various orders and ultimately make sure that you select an ordering that clearly illustrates the search runs into the obstacles at some point (i.e. don't pick directions that means you never visit a grid cell that is occupied by an obstacle).



Step 2

After the search is completed, make sure that the code in place to display the visited tiles works (press 'p'). If this doesn't work, make sure you understand how cells are being added to path (and how the path is represented). In the below example image, all the cells with a black square have been visited, but the grid cells that make up the path is shown with red.



Step 3

Change the location of Obstacle and try your algorithm.

Submission and Demo

Demo and Submit your java files (as a ZIP file) in the Canvas.