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Programming and Problem Solving
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Deliverable 1

1. Introduction

1.1 Abstract

We seek to create a solution to help the city of Hamelin move rats from the right side to the left side of a given field with pre-specified size. The field is divided by a wall, and the rats can only move to the left side by passing through a gate of a given size.

A general overview of our strategy is to divide up the right field by the number of Pied Pipers, and assign each section a single Pied Piper. The Pied Pipers will traverse their section of the field, direct the rats towards the gate, and attract the rats to the left side of the field.

1.2 Problem Statement

The goal of this project is to control the Pied Pipers to attract and direct the rats from right side of the field to the left side. The action takes place in a field of side length F meters which is partitioned by a fence into two parts. There is a 2m gate in the middle of fence. The project begins with the Pied Pipers located on the left edge of the field, and the rats randomly distributed on the right side.

Pied Pipers can be in two different states: play music, which lures the rats, and move at a speed of 1m/s; remain silent, which has no influence over the rats, and move at a speed of 5m/s. When a Pied Piper is within 10m of a rat but father than 2m, the rats will follow the piper at the speed of 1m/s. When a rat is within 2m of a Pied Piper that is playing music, the rat stays where it is. However, if a rat is left alone without a Pied Piper playing music in its general vicinity of 10m, the rat will wander at 1m/s.

There are two potential goals for the project: to attract all of the rats to the left side of the field as quickly as possible and to attract as many rats as possible to the left side of the field within the limited time frame.

1.3. Terminology

Field	The area that the Pied Pipers and rats are in.
Fence	A boundary across the field and vertically along the middle that Piped Piers are not allowed to pass through and rats bounce off of like a ray of light when hitting it.
Gate	A 2m wide gap along the middle vertical fence that rats could pass through to move from one side to the other.
Pied Piper	A Pied Pipers whose purpose is to entice rats . The player's code was used to control the movement of one of these Pied Pipers.

Rats	Rat that is enticed by Pied Pipers to be driven into the gate.
Tree Triangulation	Divide the field in to triangle and traverse the triangle with tree-like path to collect rats.

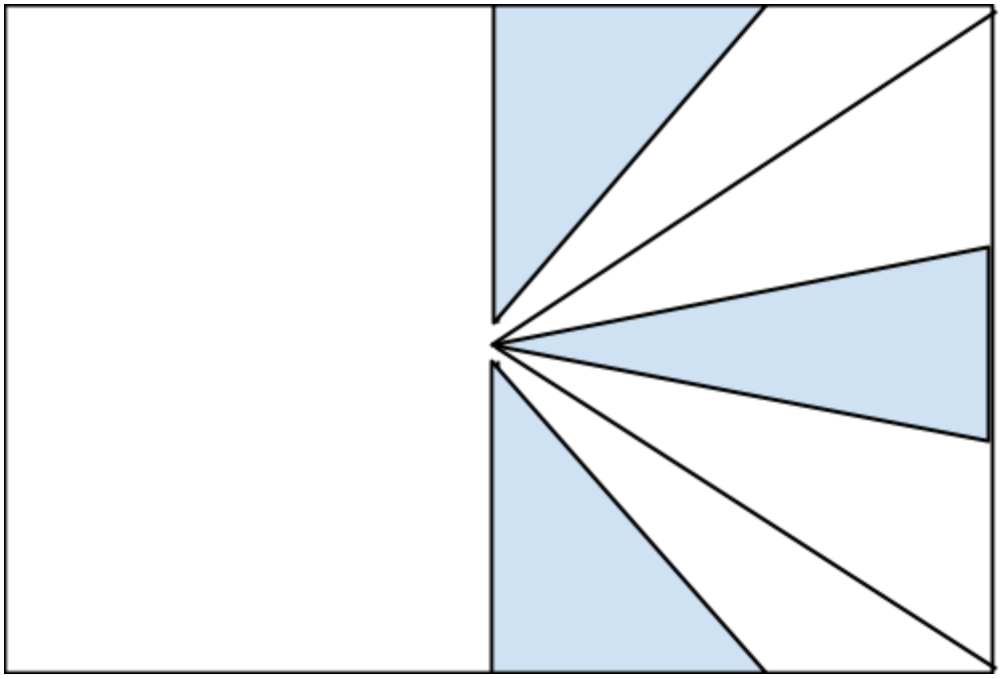
2. Strategy and Evolution

A general overview of our strategy is to divide up the right field by the number of Pied Pipers, and assign each Pied Piper a single section. The Pied Pipers will traverse their section of the field, direct the rats towards the gate, and attract the rats to the left side of the field.

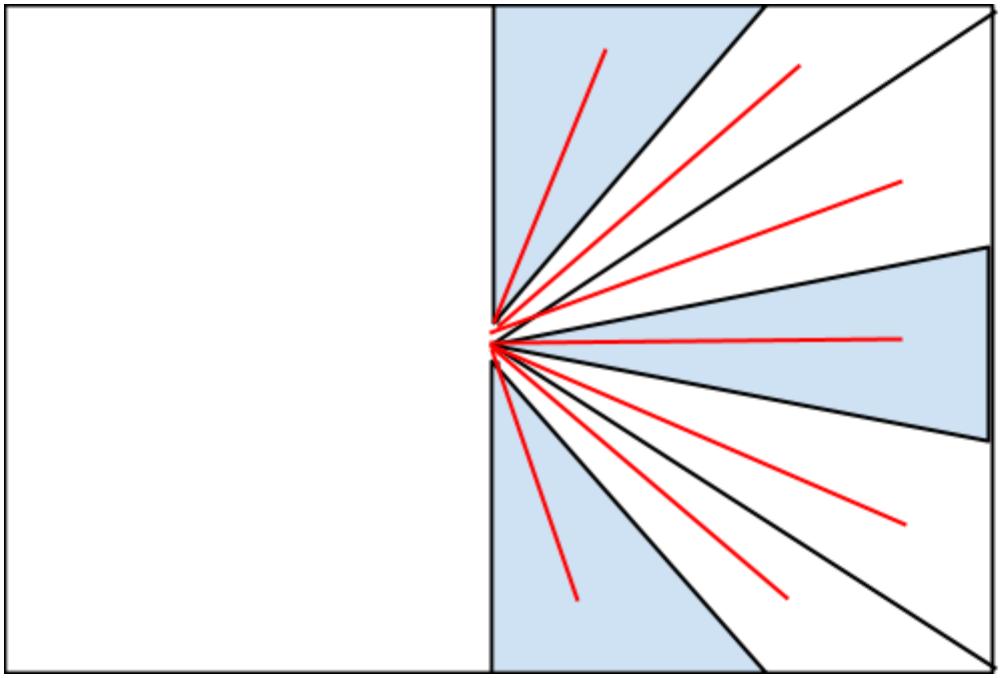
2.1 Detailed Overview

Our Pied Pipers will begin by moving quickly through the gate. Upon crossing to the other side of the wall, the Pied Pipers will divide the field into triangles with the gate being a vertex for all of the triangles. Each Pied Piper will have a triangle as its designated region.

This is an example of how the field would be divided with seven Pied Pipers:



The Piper Pipers have movements in the shape of a tree, with the gate being the center. The Piper Pipers will move quickly through branches of the tree. Once the Pied Piper reaches the end of the tree's branch, which will be located 10 meters from the furthest wall, it will begin to play music, and move back towards the center of the tree while directing the rats that have been attracted to it towards the gate. Once all of the rats in a Pied Piper's divided triangle area are directed towards the gate, then it will turn off its music, and move quickly towards the gate.



The first Pied Piper will be located on the right side of the gate, in the center vertically and closer towards the gate. This Pied Piper will act as a magnet, allowing the rats which have been directed in that location to continue to move towards the gate.

Once a second Pied Piper has completed its responsibilities in its designated region, by directing all of the rats towards the gate, it will move to replace the first Pied Piper by moving into the first Pied Piper's location. The second Pied Piper will temporarily turn off its music, and the first Pied Piper will move to the opposite side of the gate while playing its music so that it can act as a magnet to guarantee that the rats will move to the other side of the gate. The second Pied Piper will then turn its music back on to make sure that any rats that were directed in its direction will continue moving towards the gate. This process will continue until all of the rats have been directed onto the other side. When all of the rats have crossed the gate, the Pied Pipers will all turn off their music and move quickly to the left side of the fence.

2.2 Justification

3. Results

4. Tournament Analysis

5. Future Improvements

6. Conclusion

7. Acknowledgements

7.1 Individual Contributions

7.2 Acknowledgements