

MathMunition: Equation Siege

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By: Aidan Javidpour, Joel Keaton, Anthony Kitowicz,
Erson Ramirez Mendoza, Leon Zeltser

Instructor: Dr. James Daly

Project Overview

The Problem

— — —

- Linear equations taught in 7th and 8th grade according to Massachusetts Department of Education
- Drilling problems in classwork and homework is boring
- Create a game to make learning fun

What is MathMunition?

— — —

- Inspired by Brick Breaker and 2D platform games
- Fire cannon at a medieval castle by entering linear equations in slope intercept form ($y = mx + b$)
- Teaches students linear equations

Methodology

— — —

- Y-intercept is decided randomly, student will have to calculate a slope to destroy a specific block
- Fun and interactive to help the user get excited for the subject
- Time constraint to help players solve equations efficiently

Technology

- Using Unity game engine
- Coded in C#
- Art, music, and sound effects are made by the team



Architecture

— — —

- Scenes hold sprites such as buttons, blocks, or cannons
- Scripts control the behavior of the objects
- Data stored in game files using PlayerPrefs class

Hardware Requirements

— — —

- Need a working mouse and keyboard
- Windows device needed to use downloadable version
- Everyone can play the browser version also on the website

How to Play

— — —

- Executable version (Windows only) on website
- Browser version on website
- <https://jojojo8359.github.io/SWE-Project/>

Overview of Features

Level Layout

— — —

- Castle on one side of the screen, one cannon on the other (on the y-axis)
- Space on top to enter equation
- One block in the castle is the target, if destroyed the player wins
- Player has limited amount of time to complete level, based on difficulty

Gameplay

— — —

- Player enters a linear equation to fire cannon
- Player enters slope, y-intercept has been decided randomly
- That equation becomes the trajectory of the cannonball
- Cannonball travels until hitting block or ground or flying off the screen

Other Features

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- Three difficulties (easy, medium, hard)
- Get a score based on how many blocks destroyed
- High scores from every level and difficulty are saved

Future Work

— — —

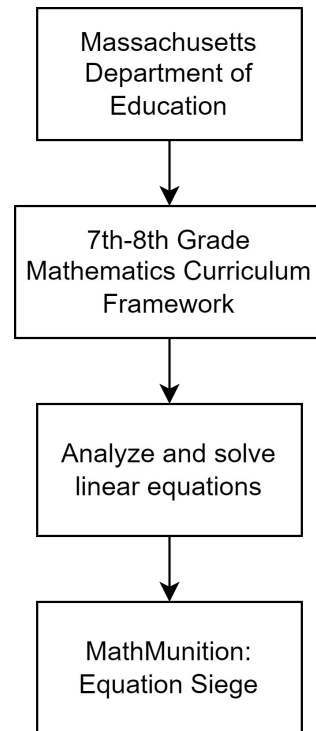
- More levels and randomly generate level layouts
- Ability to pause, save, and quit level
- Scratchpad so the player can do quick calculations
- Add more themes
- Extend it beyond linear equations

Domain Research

Domain Research

— — —

- Massachusetts Department of Education requires that linear equations are taught in 7th or 8th grade
 - “In grade 7, instructional time should focus on four critical areas: [...] (2) developing understanding of operations with rational numbers and working with expressions and linear equations”
 - “In grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including [...] solving linear equations”



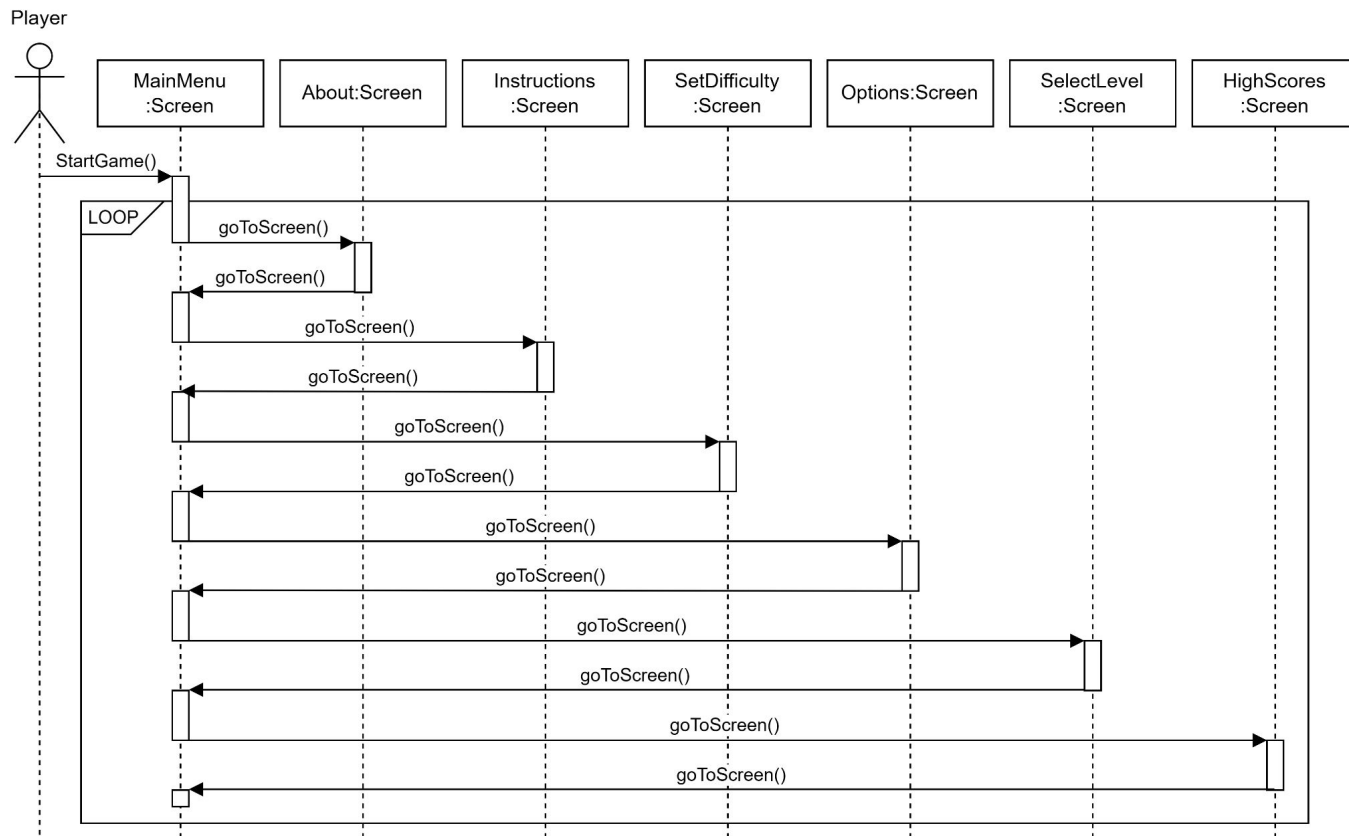
Constraints

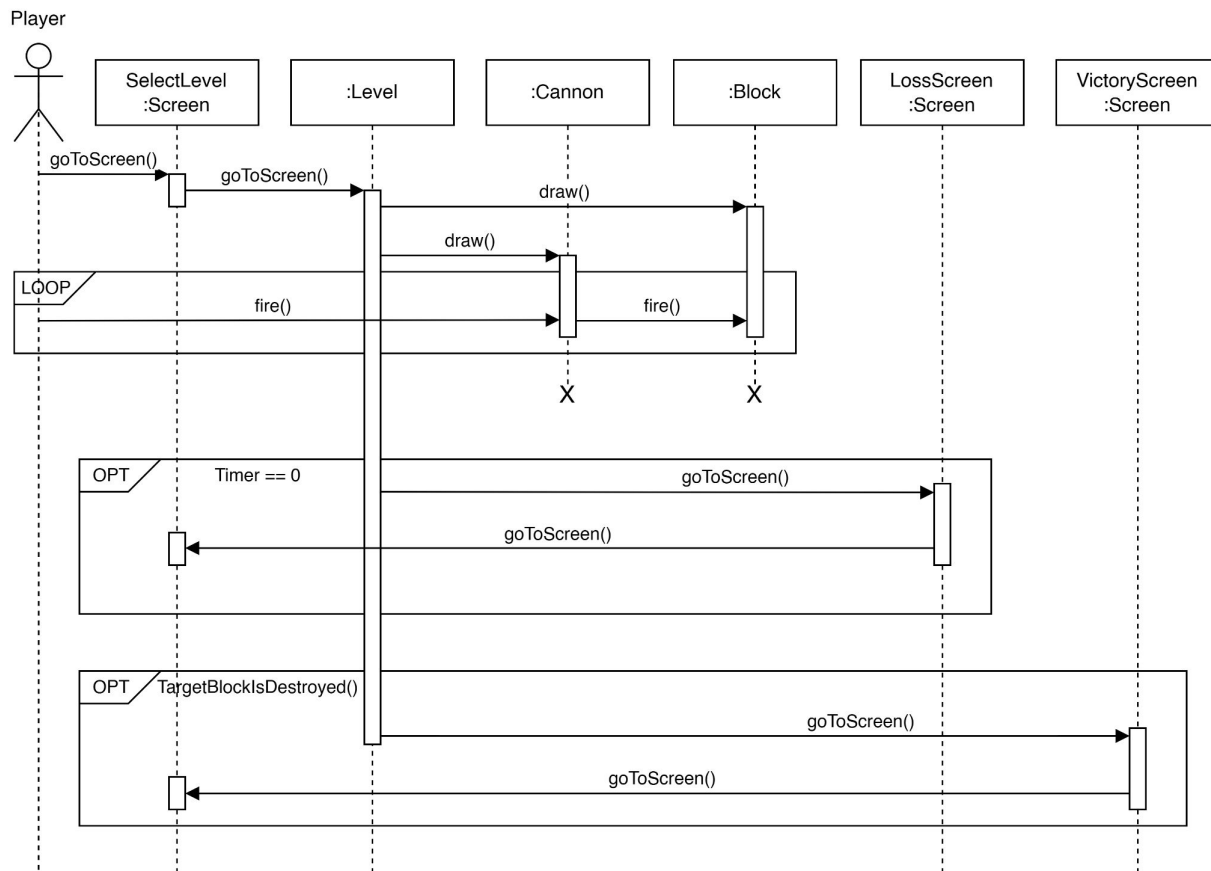
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- Limited time to work on prototype
 - Were not able to implement all features we planned on having
- Team was unfamiliar with tools, needed to learn them
- Game is written in English, no support for other languages

Sequence Diagrams

Menu Diagram





Demonstration

Main Menu

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Help Screen

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About Screen

— — —



Options Screen



Difficulty Select Screen

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Level Select Screen



Gameplay - UI

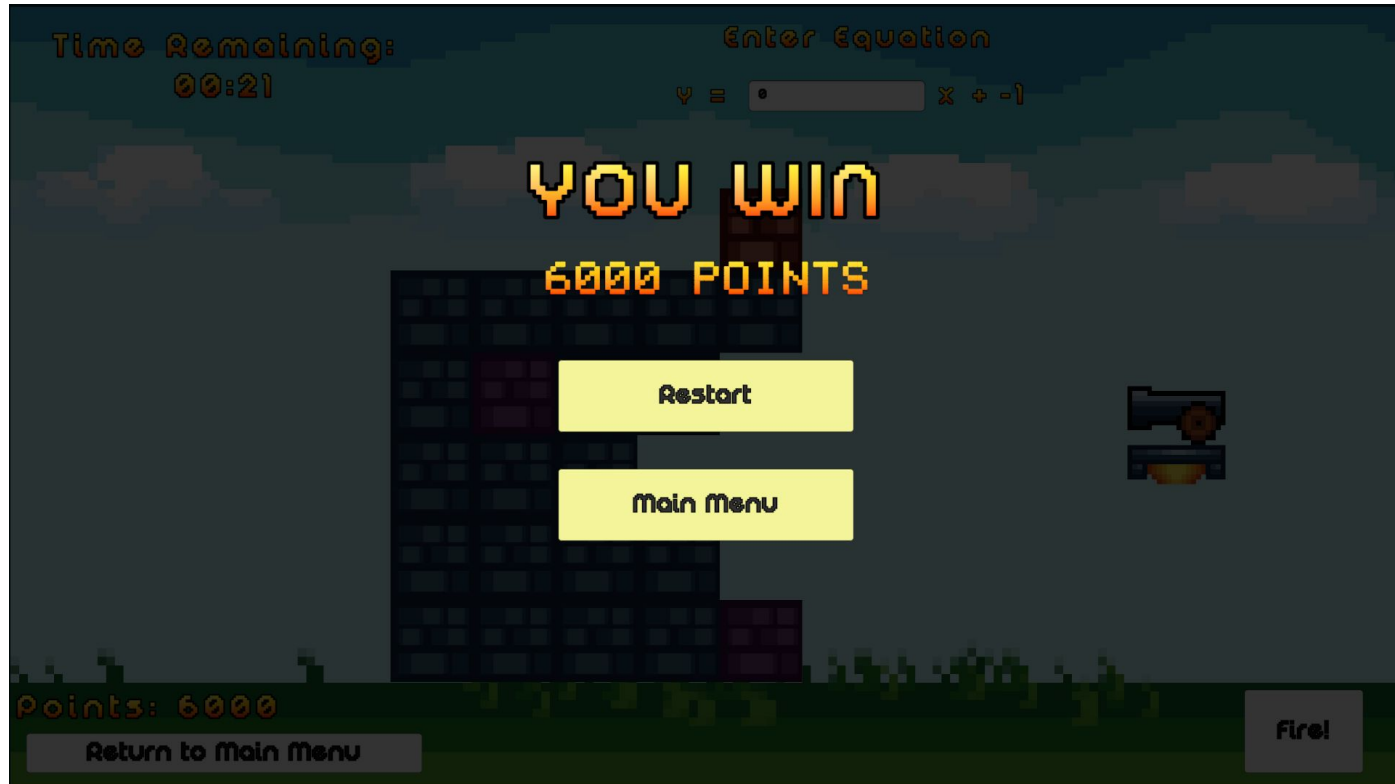
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Scenario #1 - Win The Game

— — —



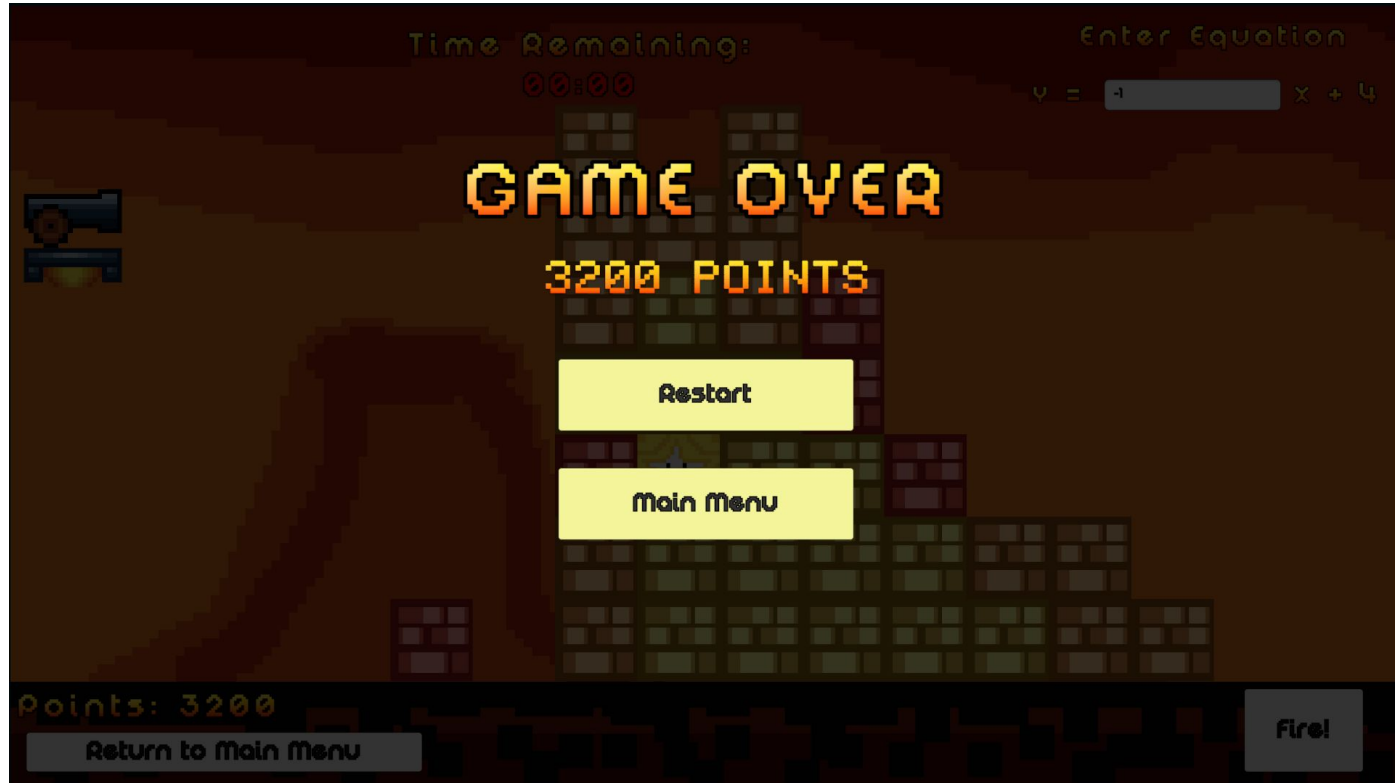
Gameplay #2 - Cannon Flip

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Senario #2 - Time Runs Out & Game Lost

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High Score Screen

Scores:

Easy

Medium

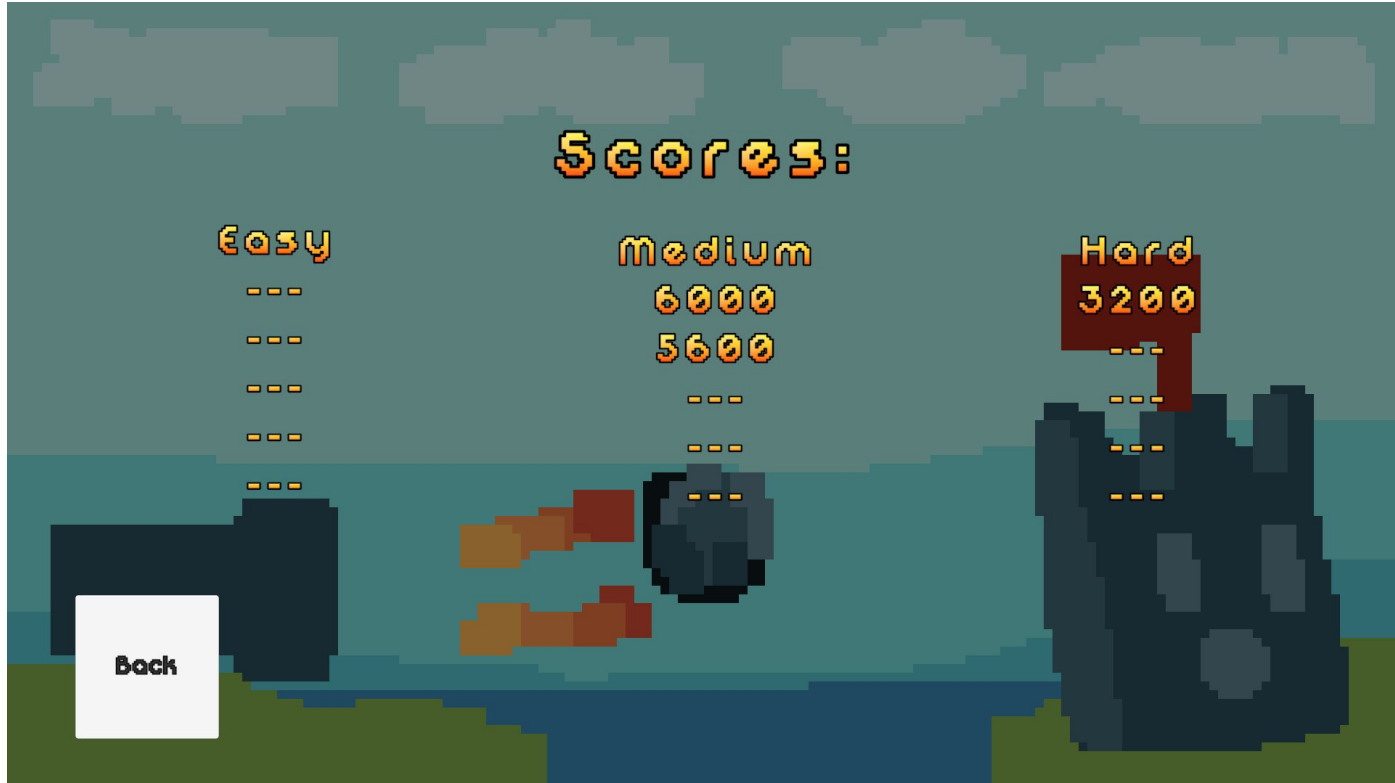
6000

5600

Hard

3200

Back



Final Notes

Acknowledgements

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Thank you to Dr. James Daly and other students for their feedback on early versions of this project.

Massachusetts Department of Elementary and Secondary Education,
“Massachusetts Mathematics Curriculum Framework – 2017.” Massachusetts
Department of Elementary and Secondary Education, 2017.
<https://www.doe.mass.edu/frameworks/math/2017-06.pdf>.

Thank You

Questions?