Math Moles

Software Engineering COMP 4110
University of Massachusetts Lowell
Fall 2025

Team Members:

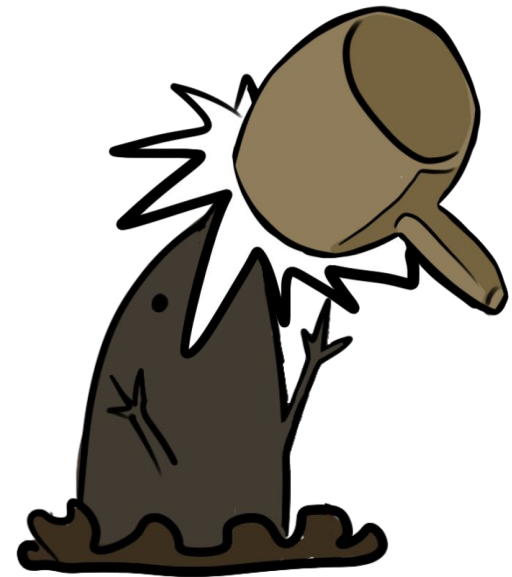Project Manager: GJ Burlingame

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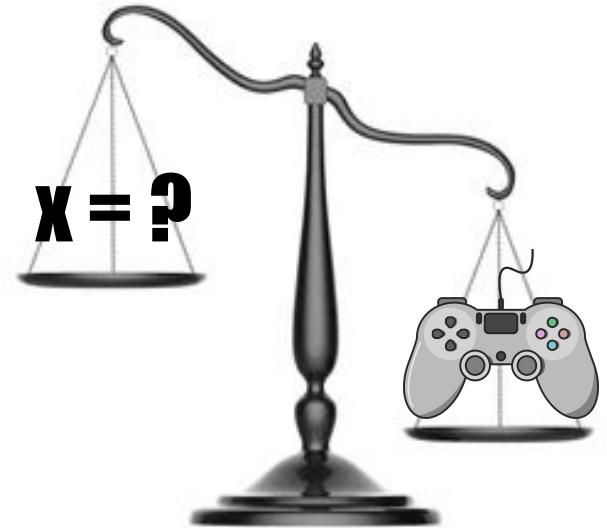
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Instructor: Dr. James Daly

Project Overview

Getting students to practice math problems can be tough…
- Worksheets are boring
- Playing video games is a much more enticing option

$x = ?$

What's the solution?

Turn the math practice into a video game!

Project Overview

Math Moles is a whack-a-mole-style game where players solve algebraic equations to score points.

Race against the timer to score as many points as possible!

Stay consistent! Each successive correct answer earns you more points.

Play again and again to beat your highscore!

Motivation & Methodology

Practice makes perfect: Repetition is crucial to learning a new skill.

- Our game will help students in the 6th-8th grade develop and improve their equation-solving speed and proficiency

Encourage Practice: Make math practice fun to get students motivated to practice.

- Point system and fun graphics keep students engaged

Architecture

Spawning

- Enemies are spawned at random time intervals in a 3x3 grid

- Each mole is composed of an equation
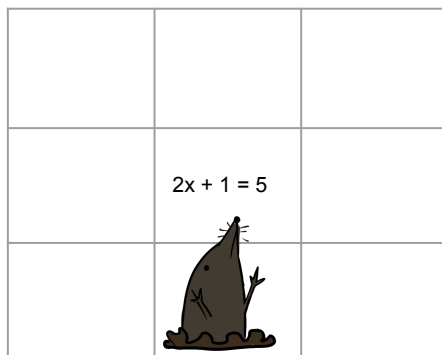

$2x + 1 = 5$

Figure 1: Simplified diagram showing a spawned mole in the 3x3 grid spawn area

Score-keeping

- Entering an equation checks all moles on screen. If one mole solution matches your input, your score is increased

- Points earned scales off of your streak

Leaderboard

- JSON file stores entries containing player names and their scores.
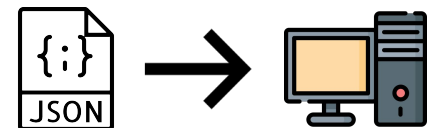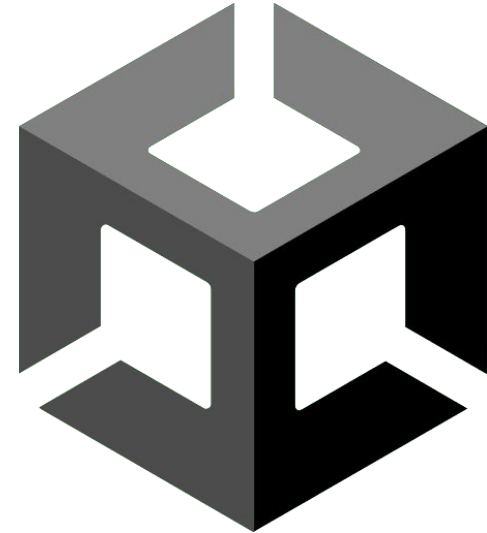
- Stored locally

Figure 2: Diagram of JSON files saved on local system

Technologies

Development:
- Unity
- C#

Version Control:
- Unity Version Control
  - (formerly Plastic SCM)

Overview of Features

- Whack-a-mole-style Gameplay

  ○ Solve equations to whack the moles before they disappear back into the ground.

- Answer Streak

  ○ Earn more points when you answer correctly multiple times in a row

- Leaderboard

  ○ Locally stored leaderboard displaying player-entered names with their respective score

- Tutorial

  ○ Short and easy-to-understand information on how to play the game, accompanied with helpful visuals

Use-Case Diagram

Main Menu Use-Case Diagram:
- **Start Game**
  - Starts a new game session of Math Moles.
- **Provide Username**
  - The player provides a username to be displayed on the leaderboard.
- **Open Settings Menu**
  - Opens the menu where the player can adjust the game's volume.
- **Start Tutorial**
  - Opens the tutorial menu where the player can learn more about Math Moles.
- **Exit Game**
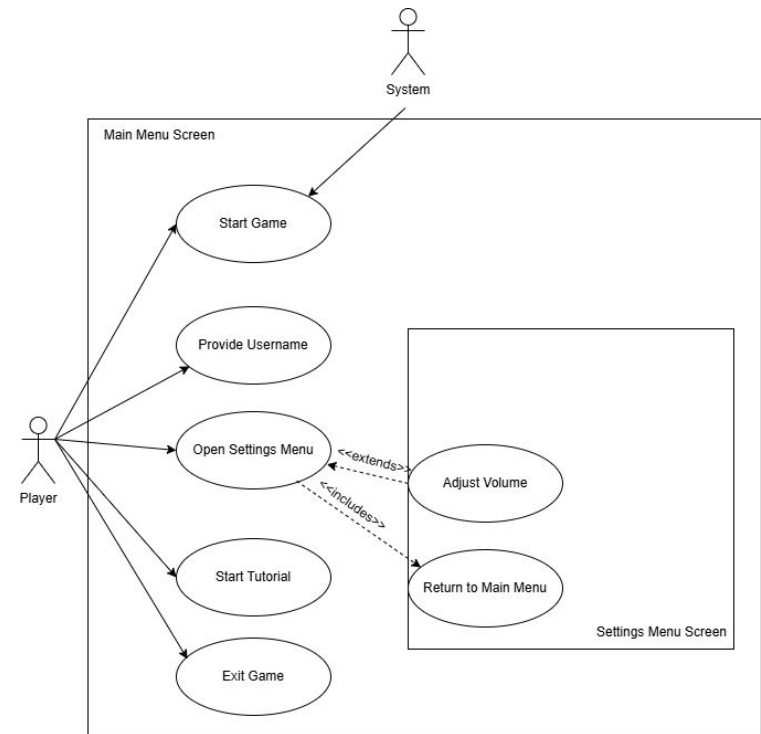 - Closes the application window.

Figure 3: Main Menu Use-Case Diagram

__Demo__

The following demo will demonstrate everything Math Moles has to offer.

Some graphics remain unfinished, but the core features that make the game educational and playable have been implemented.

Demo Pt. 1

Upon opening the game, the player will see the Main Menu and be met with various options:

– Start Game

– Settings Menu (allows for volume adjustment)

– Tutorial

– Exit

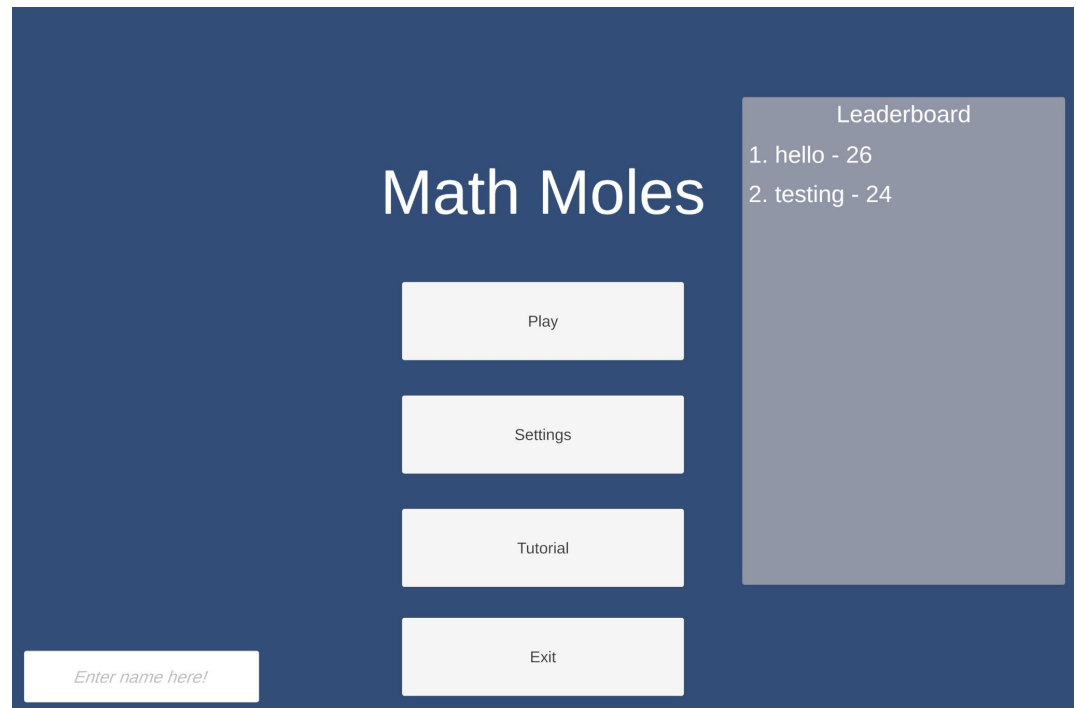– The player can provide a username in the bottom left corner

Figure 4: Main Menu

Demo Pt. 2

If the player does not know how to play, they may choose to enter the tutorial:

It will provide everything they need to know about the game.

Players can navigate through each screen with the two buttons labeled Previous and Next.
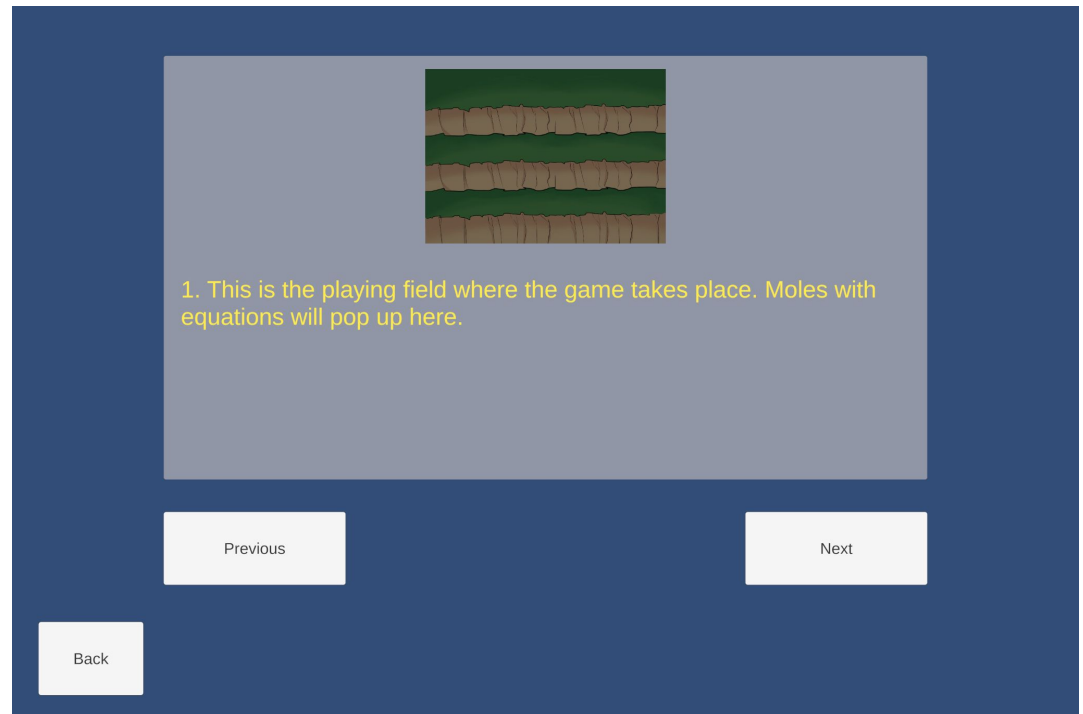

Figure 5: Tutorial Screen

Demo Pt. 3

When the player starts the game, their screen will look like this:

The <u>timer</u> in the top right corner <u>will begin counting down immediately</u>

The first mole will appear on screen soon, displaying an equation that must be solved.
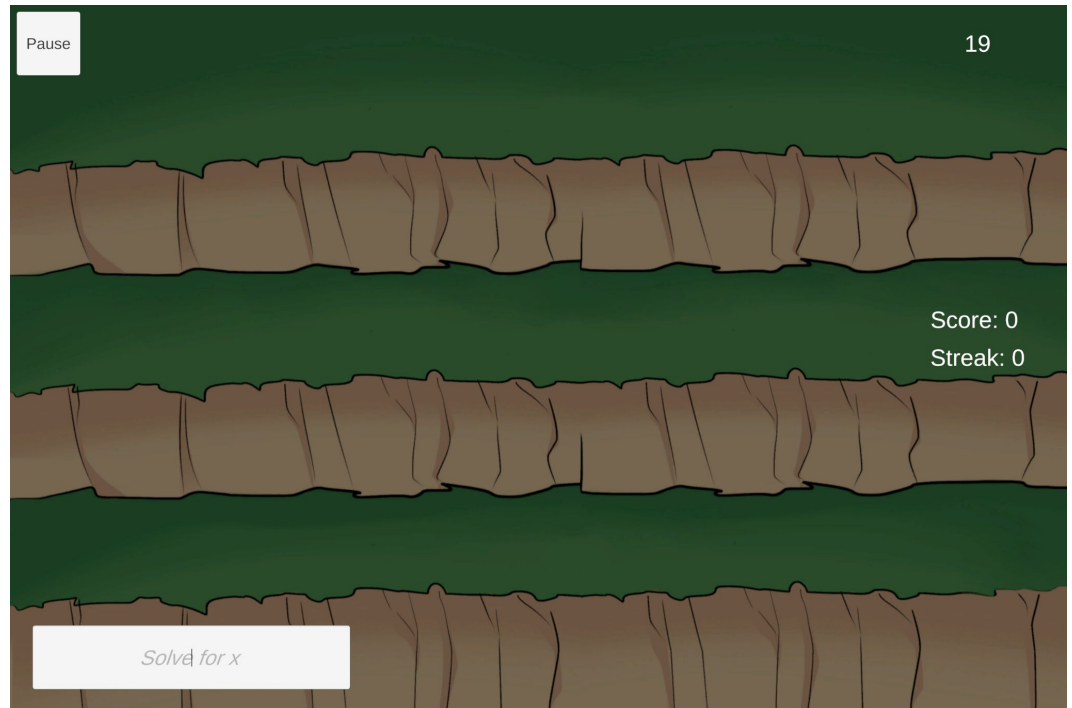

Figure 6: Field at the start of the game

Demo Pt. 4

The first mole has appeared!

The player must <u>solve for x before</u> the mole disappears.

The bar below the mole will <u>change color as time runs out</u>.

If the player does not answer the equation in time, the mole will disappear without awarding points

Figure 7: A mole spawning on the field

Demo Pt. 5

A correct answer:

A hammer appears to send the mole back underground.

Points are awarded, scaling with the player's current streak.
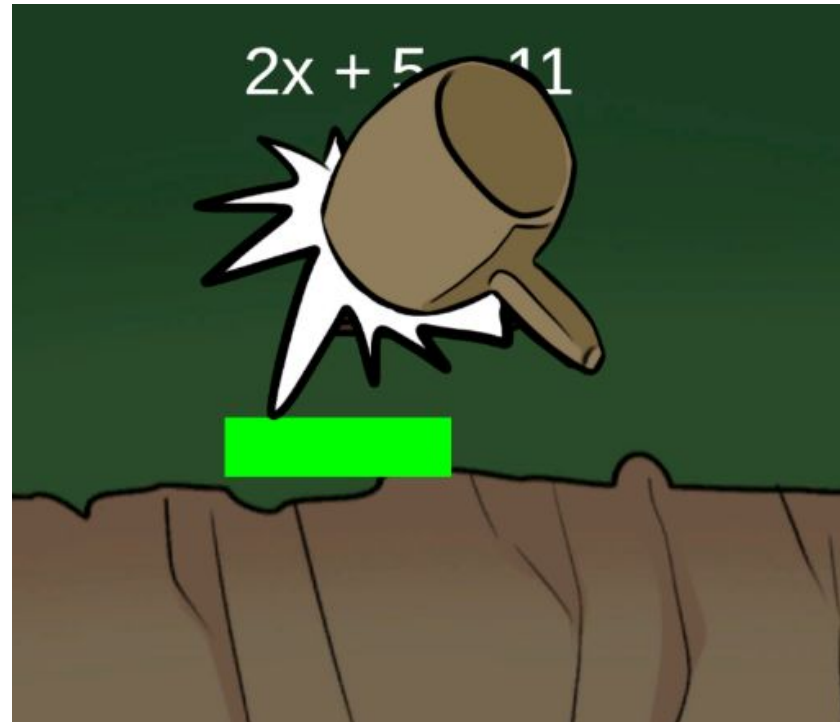
The player's streak is incremented by 1.

Figure 8: A mole being whacked

Demo Pt. 6

An incorrect answer:

<u>The mole remains on-screen</u>, giving the player another chance to correctly answer the equation

The player's <u>streak has been reset</u>, they will not gain as many points from subsequent correct answers
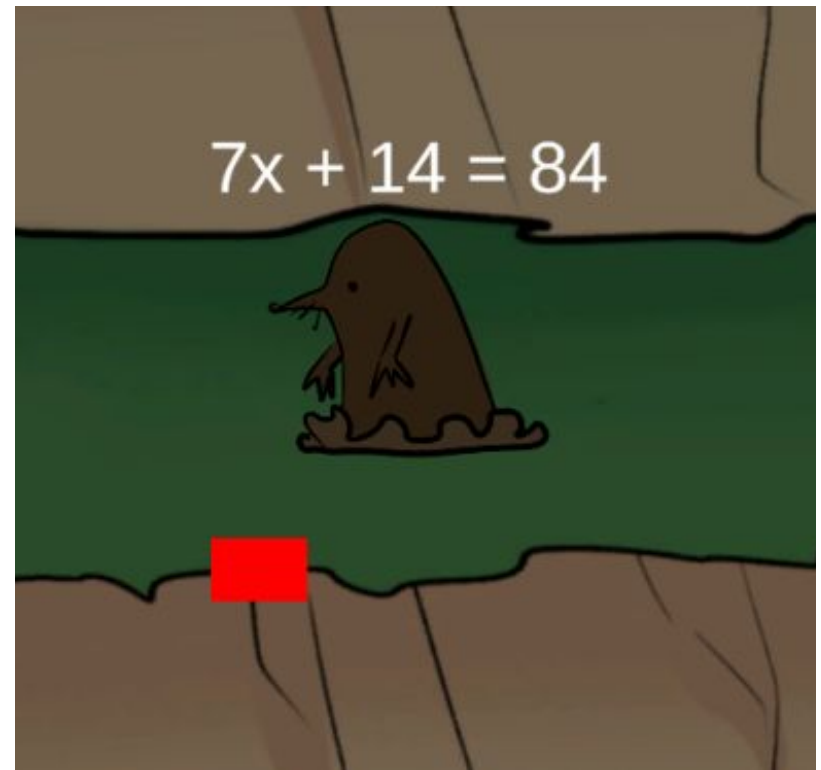

Figure 9: A mole with low remaining time.

Demo Pt. 7

Game over:

Time has run out

The player's final score is displayed

If the player achieved a high score, it will be added to the leaderboard

They can return to the main menu to play again
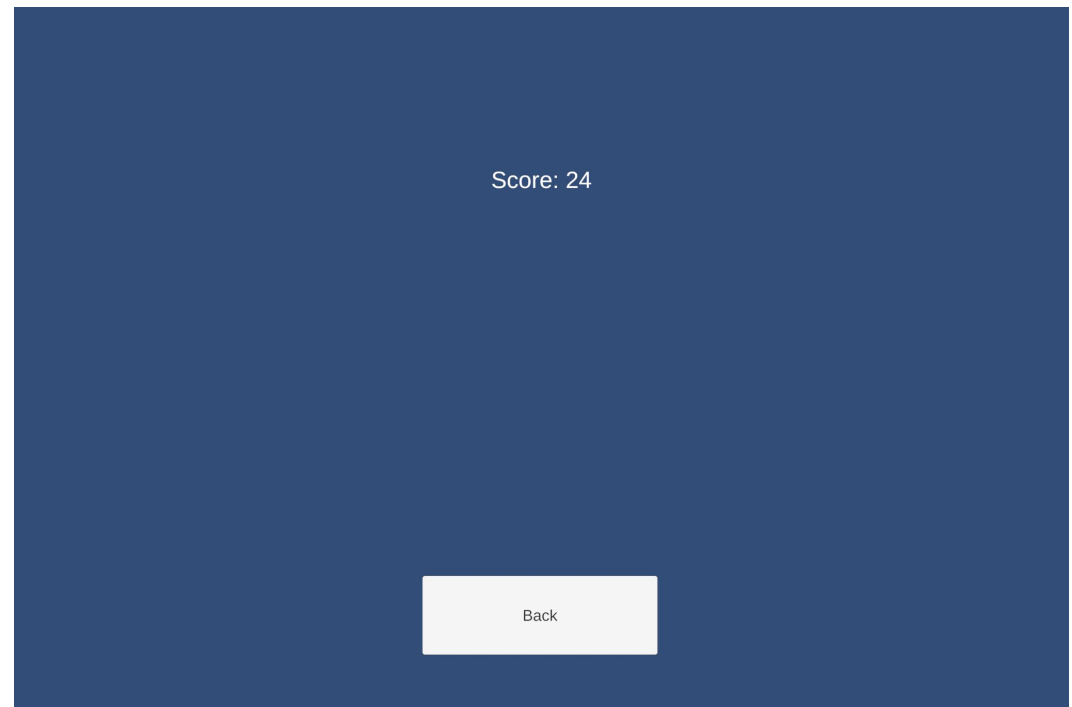
Score: 24

Back

Figure 10: Game over screen

Potential Improvements

Ideas that:

- make the game more engaging
- expand the audience of the game
- add more depth to the game

Difficulty System

Benefits:
- more incentive to improve
- adds replayability
- expands audience range

Our idea:
- add a range of difficulties the player can select
    - harder equations
    - less time to solve a mole

Figure #: Early sketch of difficulty selection screen

Competition

Benefits:

- more incentive to improve
- adds replayability

Our idea:

- a leaderboard that shows global scores

Figure #: Early sketch of global leaderboard feature

Enhanced visuals

Benefits:

- visual appeal -> more engaging

Our idea:

- animated assets
- graphs that show player score progression

Figure #: Early design sketch of how the hammer would be animated

Figure #: Early sketch of a potential graph feature that would show user improvement

Post-game review

Benefits:

- Good for practice and improvement

Our idea:

- Add area in the post-game screen where players can see their incorrect answers and the moles that took the longest to whack

Figure #: sketch of global leaderboard feature

Research

- **2017 Curriculum Framework for Mathematics Detailed Revisions of 2010 Standards for PK-12.**
  https://www.doe.mass.edu/frameworks/math/2017-06revisions.pdf

  - This framework helped us decide what level of math content would be appropriate for the target audience of Math Moles.

Thank you for your time.

Any questions?

Image Sources

https://generic.wordpress.soton.ac.uk/digital-learning/2017/11/15/live-demo-staff-club-highfield/

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