Fall 2022 CS 3330 Final Project Documentation

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I'm Adam, a CS major at the University of Missouri. My project for CS 3330 in Fall 2022 is the Grid Games Modifier, which I will introduce in the following sections.

I. Overview

Games have always been a prevalent part of society. Their design sometimes seem random, and may bring people to wonder how the designers went with the decisions they chose.

This project allows you to play 3 classic grid-based games, while also allowing you to customize their rules in ways that you normally cannot play with.

II. Purpose of the project

The purpose of this project is to give insight into why the designers of these games set the rules to what they are. Why do the different difficulties of minesweeper have these specific dimensions, with this specific amount of mines? Why does 4 in a row opt for a win state of 4 connected pieces, with specifically a 7x6 area? Why does tic-tac-toe take place in a 3x3 grid, requiring 3 connected symbols to win?

The most important question here is what would happen if these rules were changed. Pushing the rules of each game to their limits gives you an insight into how the developers settled on the numbers they chose, and what balance they tried to strike when setting up the game. What happens if you turn minesweeper into a single-row guessing game? Would an 8-player version of connect 4 where you only need to connect 2 pieces work as a game? What if you had to connect 4, but each column was only 4 spaces tall? What if gravity shifted every time someone connected 3 in connect 4? With this program, these questions change from hypotheticals to things you can easily test the outcome of.

III. Functionalities of the project

There are two main functionalities in the app: the start menu and the gameplay.

1. The Start Menu

When the program runs, the user is given a welcome message. They are then prompted to choose between 1 of 2 different game modes, or to display an info menu describing the rules of the preset games. Once a choice is made, users can then decide whether to play a preset board of their chosen game, or change the rules to whatever they want (within certain limits). If at any point the user goes back on a decision, they can go back to a previous part of the menu.

For each game, there are different presets and different options to mess around with.

Minesweeper modes: BEGINNER, INTERMEDIATE, EXPERT, CUSTOM.

BEGINNER: 9x9 grid, 10 mines.

INTERMEDIATE: 16x16 grid, 40 mines.

EXPERT: 30x16 grid, 99 mines.

CUSTOM: [1-30]x[1-30] grid, [1-MAX] mines. (MAX is the amount of mines that would completely fill your chosen grid size).

Connect to Win modes: CONNECT 4, TIC-TAC-TOE, CUSTOM.

CONNECT 4: 2 players, 7x6 grid, 4 in a row to win, gravity enabled.

TIC-TAC-TOE: 2 players, 3x3 grid, 3 in a row to win, gravity disabled.

CUSTOM: [2-8] players, [2-30]x[2-30] grid, [2-30] in a row to win, (note: you cannot require a certain amount in a row if at least one dimension of the grid is not that size). Gravity (enabled/disabled/contingent). Selecting contingent gravity brings up one more menu that allows a few options for what will change the gravity. You may select between UP-AND-DOWN and ALL-4-DIRECTIONS. You may then select what triggers changes in gravity: CONNECT-X-AMOUNT or EVERY-X-TURNS. You then input a value for x (if you select "connect-x-amount," your value must be lower than the amount of connected pieces required to win).

```
Welcome to the Grid Games Modifier! You can play games normally or experiment with changing their rules!
type 0 to display INFO, 1 to play MINESWEEPER, or 2 to play CONNECT-X.
0
******************************
MINESWEEPER:
    clear the board without selecting any hidden mines to win.
    Spaces will show a number showing how many mines they are directly touching. You may flag where you believe mines to be.
CONNECT-X:
    Games like Connect-4 or Tic-Tac-Toe have multiple players taking turns placing markers for their team. Chain a certain amount of markers to win.
    For Connect-4, gravity is turned on and 4 pieces must line up.
    For Tic-Tac-Toe, gravity is turned off and you must connect 3 pieces.
******************************

type 0 to display INFO, 1 to play MINESWEEPER, or 2 to play CONNECT-X.
1
Choose a gamemode! CUSTOM (0), BEGINNER (1), INTERMEDIATE (2), EXPERT(3)
0
How many spaces across should the board be? [1-30]
20
How many spaces tall should the board be? [1-30]
16
How many mines should there be? [1-320]
50
************************************************************
     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
    -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
A |  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?|
B |  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?  ?|
```

```
Welcome to the Grid Games Modifier! You can play games normally or experiment with changing their rules!
type 0 to display INFO, 1 to play MINESWEEPER, or 2 to play CONNECT-X.
2
Choose a gamemode! CUSTOM (0), CONNECT-4 (1), TIC-TAC-TOE (2)
0
How many players? [2-8]
2
How many spaces across should the board be? [1-30]
4
How many spaces tall should the board be? [1-30]
30
How big of a chain is required to win? [1-30]
4
Is gravity enabled? [0: disabled, 1: enabled]
1
How should gravity work? [0: unchanging, 1: swap UP-AND-DOWN, 2: cycle ALL 4 DIRECTIONS
2
What changes gravity? [0: X turns pass, 1: Player connects X+ markers, 2: Player connects X (exact) markers]
2
X=? [1-3]
3
```

2. The Gameplay

Each game's grid has a maximum size of 30x30. Selecting a tile is done by typing the row, followed by the column (example: A1, @34, T07). The columns run from 1-30, while the rows run from A-Z, followed by !, @, #, and $ for the final four characters.

For minesweeper, you are given the option between placing a flag and guessing a space. Flags are represented with F on the board. NOTE: IT IS POSSIBLE FOR YOUR FIRST CHOICE TO BE A MINE. THIS IS INTENTIONAL (for the sake of allowing users to create a custom mode of minesweeper where there is only 1 safe spot, etc.).

For the connect-x games, control will cycle between the amount of players selected for the game, and player-specific pieces are represented by a 1, 2, 3, etc. respectively.

Once a win state is reached, a win message is displayed and the user is returned to the start menu.

NOTE: THIS PROGRAM WAS NOT BUILT WITH ADDITIONAL GAMES IN MIND.

```
**************************************************
     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16
    -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
A |        1  1  1     1  1  ?  ?  ?  ?  ?  ?  ?  ?|
B |        1  F  1     1  F  ?  ?  ?  ?  ?  ?  ?  ?|
C |        1  1  2  1  2  1  1  2  ?  ?  ?  ?  ?  ?|
D |              1  F  2  1     1  ?  ?  ?  ?  ?  ?|
E |  1  1  1     1  2  F  1     1  ?  ?  ?  ?  ?  ?|
F |  1  F  1        1  1  1     1  ?  ?  ?  ?  ?  ?|
G |  1  1  1                 1  1  2  ?  ?  1  1  2  F|
H |  1  1                    2  ?  ?  ?  ?  2     2  2|
I |  F  1                    2  ?  ?  ?  ?  2     1  F|
J |  1  1                 1  2  ?  ?  ?  2  1     1  1|
K |                       1  F  2  3  F  2           |
L |        1  2  2  1  1  1  1  2  F  2        1  1|
M |        1  F  F  1           1  1  1        2  ?|
N |     1  2  4  3  2                       2  ?|
O |  1  2  F  4  F  3  2  2  2  2  1  1     1  2  ?|
P |  1  ?  ?  ?  F  F  2  F  F  2  F  1     1  ?  ?|
    -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
TURN #43

Choose a point on the grid! [A1-P16]
```

```
P2
Toggle flag on this node [F]? or Discover it [ENTER]? 20 flags left.

**********
**********
**********
GAME OVER!

YOU LOST!
**********
**********
**********
**************************************************
     1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16
    -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
A |        1  1  1     1  1  2  X  X  X  2  1     |
B |        1  X  1     1  X  2  4  X  6  X  1     |
C |        1  1  2  1  2  1  1  2  X  X  3  2     |
D |              1  X  2  1     1  2  3  X  1     |
E |  1  1  1     1  2  X  1     1  1  2  1  2  1  1|
F |  1  X  1        1  1  1     1  X  1     1  X  2|
G |  1  1  1                 1  1  2  2  2  1  1  2  X|
H |  1  1                    2  X  2  2  X  2     2  2|
I |  X  1                    2  X  3  3  X  2     1  X|
J |  1  1                 1  2  3  X  3  2  1     1  1|
K |                       1  X  2  3  X  2           |
L |        1  2  2  1  1  1  1  2  X  2        1  1|
M |        1  X  X  1           1  1  1        2  X|
N |     1  2  4  3  2                       2  X|
O |  1  2  X  4  X  3  2  2  2  2  1  1     1  2  2|
P |  1  X  3  X  X  X  2  X  X  2  X  1     1  X  1|
    -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
```

```
TURN #9

Player 1's turn!
Choose a point on the grid! [1-4]
4
****************
     1  2  3  4
    -- -- -- --
A |            |
B |            |
C |            |
D |            |
E |            |
F |            |
G |            |
H |            |
I |            |
J |            |
K |            |
L |            |
M |            |
N |            |
O |            |
P |            |
Q |            |
R |            |
S |            |
T |            |
U |            |
V |            |
W |            |
X |            |
Y |            |
Z |            |
! |            |
@ |  1         |
# |  2  1  1  1|
$ |  2  1  2  2|
    -- -- -- --
****************
<<<<<<<<<<<<<<<<
GRAVITY IS SWITCHING!
<<<<<<<<<<<<<<<<
****************
     1  2  3  4
    -- -- -- --
A |            |
B |            |
```

```
TURN #14

Player 2's turn!
Choose a point on the grid! [A-$]
F
****************
     1  2  3  4
    -- -- -- --
A |  1         |
B |            |
C |            |
D |            |
E |            |
F |  2  2  2   |
G |  1         |
H |            |
I |            |
J |            |
K |            |
L |            |
M |            |
N |            |
O |            |
P |            |
Q |            |
R |            |
S |            |
T |            |
U |            |
V |            |
W |            |
X |            |
Y |            |
Z |            |
! |            |
@ |  1         |
# |  2  1  1  1|
$ |  2  1  2  2|
    -- -- -- --
****************
^^^^^^^^^^^^^^^^
GRAVITY IS SWITCHING!
^^^^^^^^^^^^^^^^
```

```
GAME OVER!

RESULTS:
****************
PLAYER 1 WINS!
PLAYER 2
****************
     1  2  3  4
    -- -- -- --
A |  1  2  2  1|
B |  2  1  1  2|
C |  1  1  2   |
D |  1         |
E |  2         |
F |  2         |
G |            |
H |            |
I |            |
J |            |
K |            |
L |            |
M |            |
N |            |
O |            |
P |            |
Q |            |
R |            |
S |            |
T |            |
U |            |
V |            |
W |            |
X |            |
Y |            |
Z |            |
! |            |
@ |            |
# |            |
$ |            |
    -- -- -- --
```

IV. Required elements

1. Classes & Subclasses

a. Classes

i. GridGamesModifier.java

ii. GameBoard.java

iii. Node.java

iv. OptionsMenu.java

v. UserOptionException.java

b. Subclasses

i. MainMenu.java is a subclass of OptionsMenu.java

ii. MineSweeperMenu.java is a subclass of OptionsMenu.java

iii. ConnectXMenu.java is a subclass of OptionsMenu.java

iv. MineSweeperGameBoard.java is a subclass of GameBoard.java

v. ConnectXGameBoard.java is a subclass of GameBoard.java

2. Collections & Exception Handling

a. One or more collection classes

i. m_neighbors in Node.java

ii. m_nodeBoard in GameBoard.java

b. Exception Handling

i. UserOptionException.java

ii. Try-catch statements in GameBoard.java: ConnectNodes()

ii. Try-catch statements in GameBoard.java: ChooseNode()

4. Abstract Classes/Interfaces

i. OptionsMenu.java

ii. GameBoard.java