Final Project: Minesweeper

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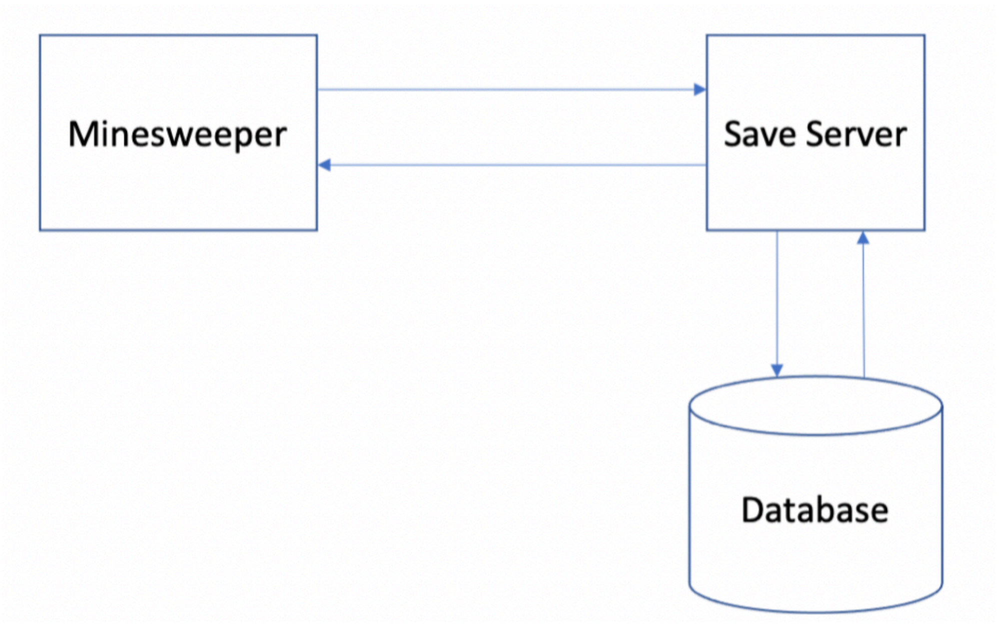
Tasks

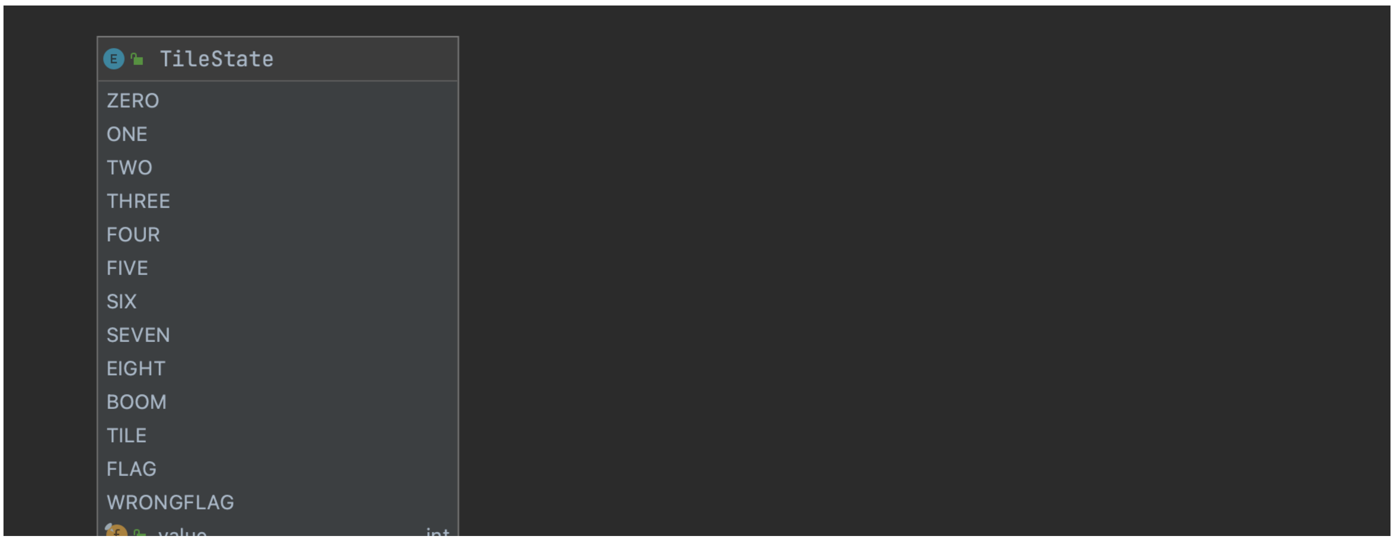
- Build the game functionally
- Load and save previous games
- Create a 1000 second timer that counts down to zero, and the remaining time on the counter is the score.
- When the counter hits zero, you lose, just as if you had hit a mine

The architecture for saving and loading game looks like this:

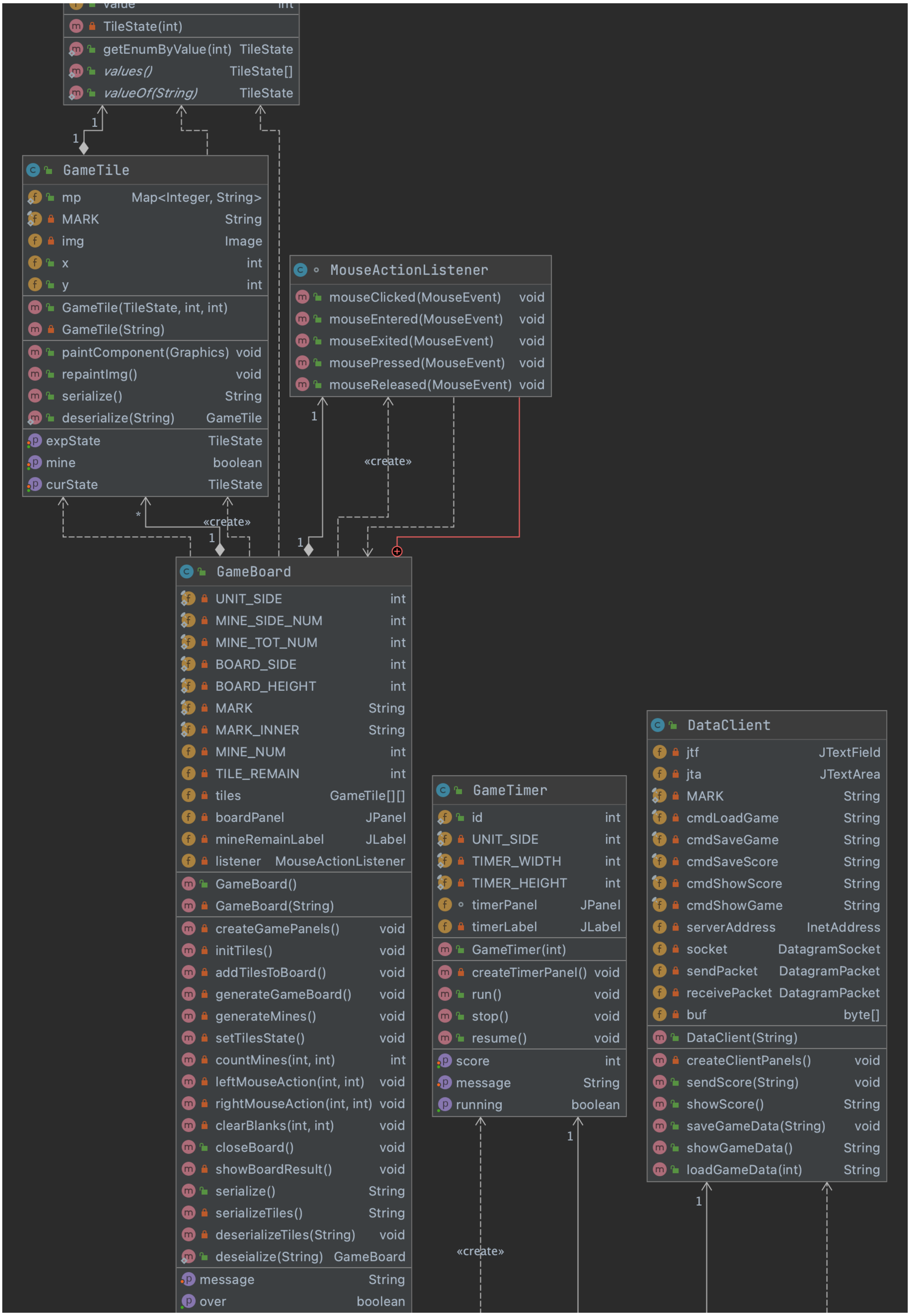


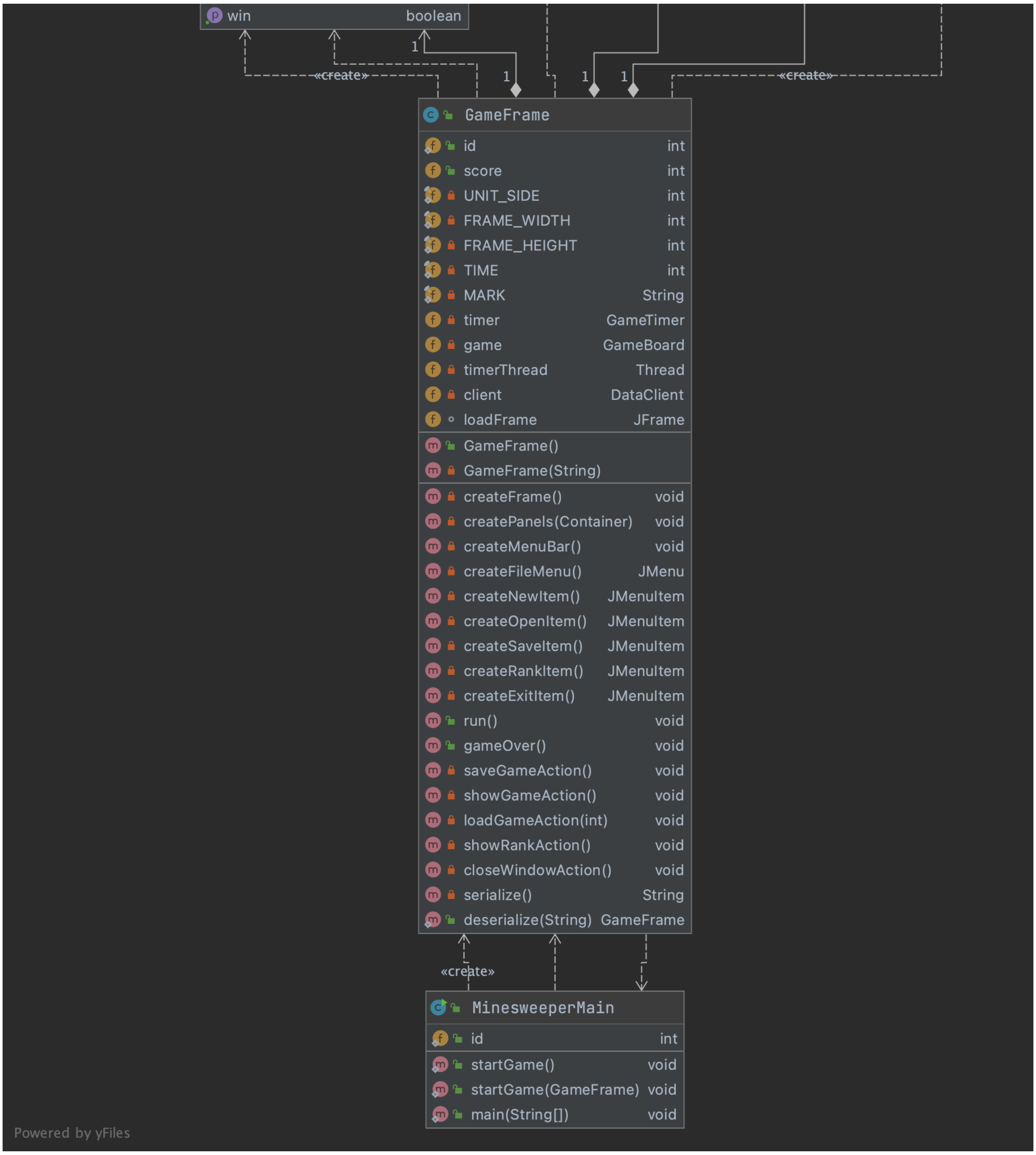
Architecture

- Game UML diagram

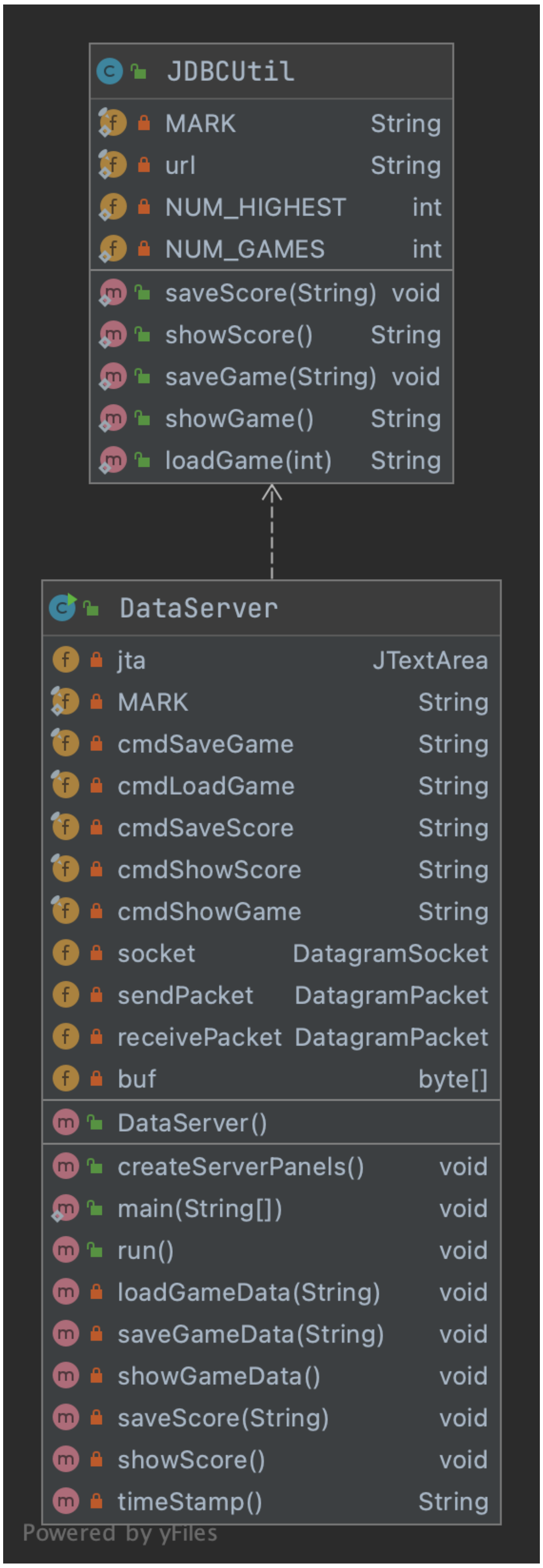


```
TileState
ZERO
ONE
TWO
THREE
FOUR
FIVE
SIX
SEVEN
EIGHT
BOOM
TILE
FLAG
WRONGFLAG
value                  int
```


value int
TileState(int)
getEnumByValue(int) TileState
values() TileState[]
valueOf(String) TileState
1
1
GameTile
mp Map<Integer, String>
MARK String
img Image
x int
y int
GameTile(TileState, int, int)
GameTile(String)
paintComponent(Graphics) void
repaintImg() void
serialize() String
deserialize(String) GameTile
expState TileState
mine boolean
curState TileState
MouseActionListener
mouseClicked(MouseEvent) void
mouseEntered(MouseEvent) void
mouseExited(MouseEvent) void
mousePressed(MouseEvent) void
mouseReleased(MouseEvent) void
1
«create»
*
«create»
1
1
GameBoard
UNIT_SIDE int
MINE_SIDE_NUM int
MINE_TOT_NUM int
BOARD_SIDE int
BOARD_HEIGHT int
MARK String
MARK_INNER String
MINE_NUM int
TILE_REMAIN int
tiles GameTile[][]
boardPanel JPanel
mineRemainLabel JLabel
listener MouseActionListener
GameBoard()
GameBoard(String)
createGamePanels() void
initTiles() void
addTilesToBoard() void
generateGameBoard() void
generateMines() void
setTilesState() void
countMines(int, int) int
leftMouseAction(int, int) void
rightMouseAction(int, int) void
clearBlanks(int, int) void
closeBoard() void
showBoardResult() void
serialize() String
serializeTiles() String
deserializeTiles(String) void
deseialize(String) GameBoard
message String
over boolean
GameTimer
id int
UNIT_SIDE int
TIMER_WIDTH int
TIMER_HEIGHT int
timerPanel JPanel
timerLabel JLabel
GameTimer(int)
createTimerPanel() void
run() void
stop() void
resume() void
score int
message String
running boolean
1
«create»
DataClient
jtf JTextField
jta JTextArea
MARK String
cmdLoadGame String
cmdSaveGame String
cmdSaveScore String
cmdShowScore String
cmdShowGame String
serverAddress InetAddress
socket DatagramSocket
sendPacket DatagramPacket
receivePacket DatagramPacket
buf byte[]
DataClient(String)
createClientPanels() void
sendScore(String) void
showScore() String
saveGameData(String) void
showGameData() String
loadGameData(int) String
1



- Server UML diagram



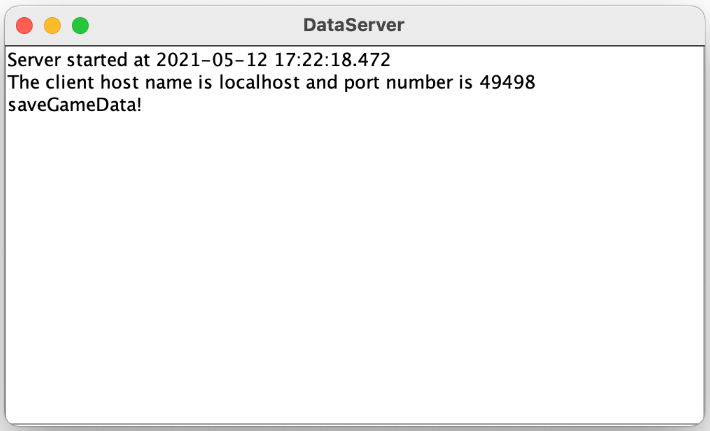
Steps to start the game

- Start the server: run **DataServer.java** in **server** package
- Run the game: run **MinesweeperMain.java** in **game** package

Noted: You can comment out line 22 in **MinesweeperMain.java** and more easily run or test the whole game. However, it is not the correct process in practical.

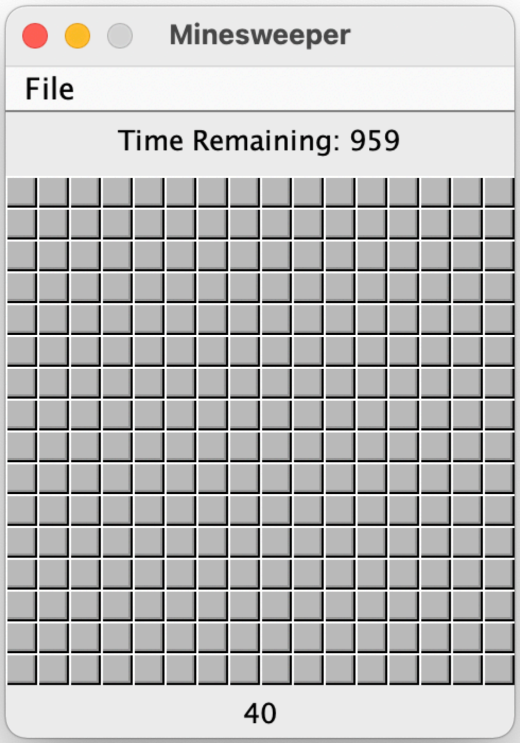
Basic features

- Server console to record the execution

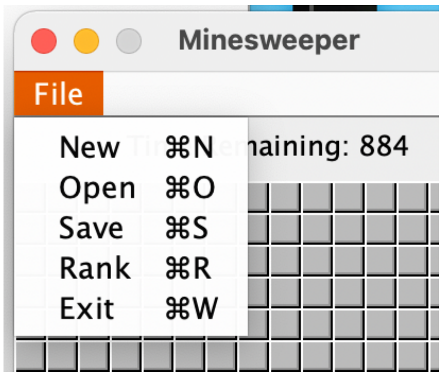


```
Server started at 2021-05-12 17:22:18.472
The client host name is localhost and port number is 49498
saveGameData!
```

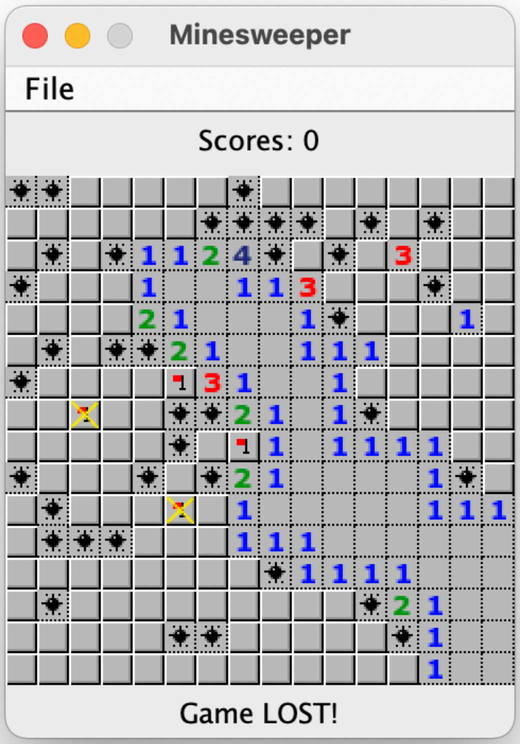
- Game panel



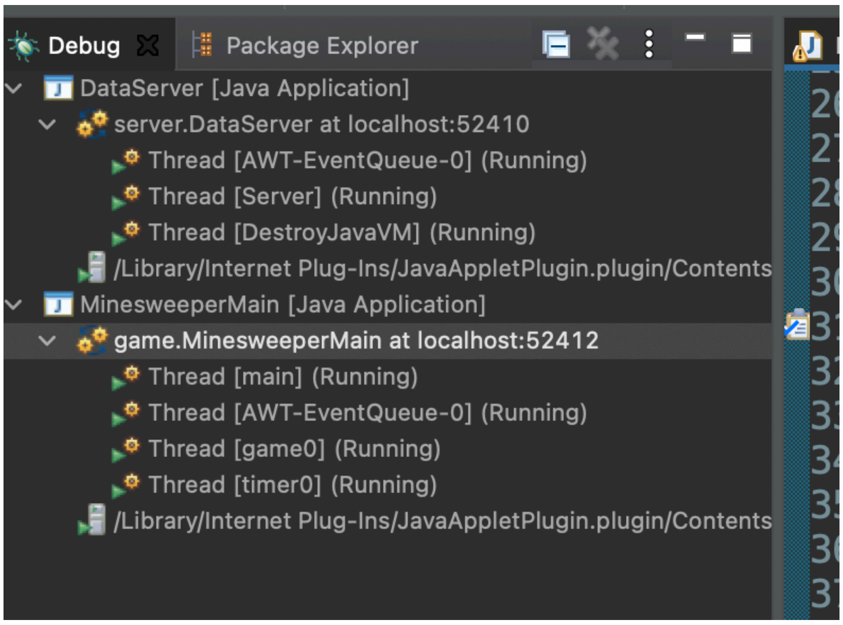
- Game menu



- Play the game



- Multi-threads



DataServer [Java Application]
server.DataServer at localhost:52410
Thread [AWT-EventQueue-0] (Running)
Thread [Server] (Running)
Thread [DestroyJavaVM] (Running)
/Library/Internet Plug-Ins/JavaAppletPlugin.plugin/Contents
MinesweeperMain [Java Application]
game.MinesweeperMain at localhost:52412
Thread [main] (Running)
Thread [AWT-EventQueue-0] (Running)
Thread [game0] (Running)
Thread [timer0] (Running)
/Library/Internet Plug-Ins/JavaAppletPlugin.plugin/Contents

- Close the game on the client: Once there are no active windows, the game will be ended automatically
- Close the server: Close the window
- Find more in the screen recording **PlayGame.mov**

Connect to the server

- Consider the speed of playing the game online, here I use UDP connection to tranfer the data
- The operations between the client and the server are recognized by command keyword, such that

```
private static final String MARK = "#"; // seperator
private final String cmdSaveGame = "save";
private final String cmdLoadGame = "load";
private final String cmdSaveScore = "score";
private final String cmdShowScore = "showscore";
private final String cmdShowGame = "showgame";
```

- In general, the client send data to the server in the following form

```
<cmdKeyword>#<data>
```

- The server only send the target data to the client

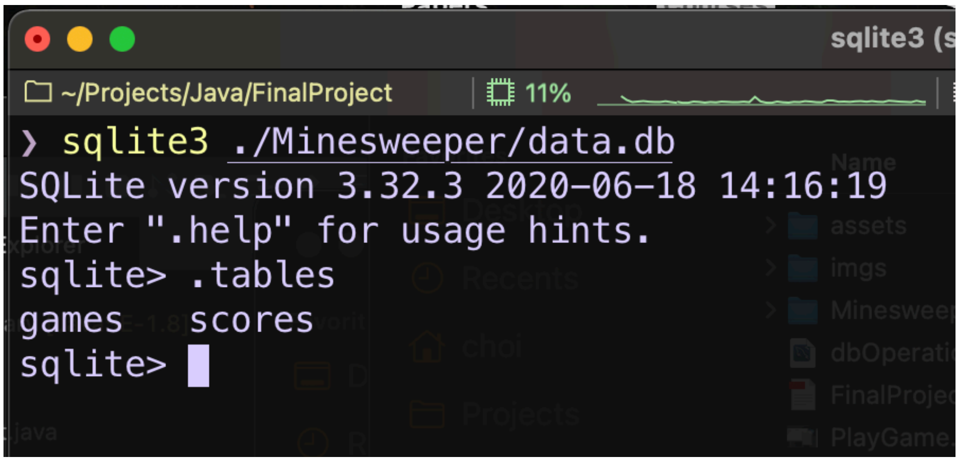
```
<data>
```

- Game scores are automatically sent to the server every time the game is ended
- Game state is serialized into a **String data** and sent to the server when **Save** menu item is executed. When the player loads a game, the server sends back the required **String data**. Then, the client will deserialize the data into a new object
- Each key values for the saved game are seperated by distinct marks in the **String data**, such as "%", "&", ";", "," etc. One **String data** example:

```
999%false&false&10,1,0,0;10,9,0,1;10,9,0,2;10,3,0,3;10,9,0,4;10,3,0,5;10,2,0,6;10,3,0,7;10,9,0,8;10,1,0,9;10,0,0,10;10,0,0,11;10,0,0,12;10,0,0,13;10,0,0,14;10,0,0,15;10,2,1,0;10,3,1,1;10,3,1,2;10,3,1,3;10,9,1,4;10,3,1,5;10,9,1,6;10,9,1,7;10,2,1,8;10,1,1,9;10,0,1,10;10,1,1,11;10,1,1,12;10,1,1,13;10,0,1,14;10,0,1,15;10,1,2,0;10,9,2,1;10,1,2,2;10,1,2,3;10,2,2,4;10,3,2,5;10,3,2,6;10,2,2,7;10,1,2,8;10,0,2,9;10,0,2,10;10,1,2,11;10,9,2,12;10,1,2,13;10,0,2,14;10,0,2,15;10,2,3,0;10,2,3,1;10,3,3,2;10,1,3,3;10,2,3,4;10,9,3,5;10,1,3,6;10,0,3,7;10,0,3,8;10,0,3,9;10,0,3,10;10,1,3,11;10,1,3,12;10,1,3,13;10,0,3,14;10,0,3,15;10,1,4,0;10,9,4,1;10,4,4,2;10,9,4,3;10,3,4,4;10,1,4,5;10,2,4,6;10,1,4,7;10,1,4,8;10,1,4,9;10,2,4,10;10,2,4,11;10,1,4,12;10,0,4,13;10,0,4,14;10,0,4,15;10,2,5,0;10,3,5,1;10,9,5,2;10,9,5,3;10,2,5,4;10,0,5,5;10,2,5,6;10,9,5,7;10,2,5,8;10,1,5,9;10,9,5,10;10,9,5,11;10,2,5,12;10,1,5,13;10,0,5,14;10,0,5,15;10,1,6,0;10,9,6,1;10,4,6,2;10,4,6,3;10,3,6,4;10,1,6,5;10,3,6,6;10,9,6,7;10,3,6,8;10,1,6,9;10,2,6,10;10,4,6,11;10,9,6,12;10,2,6,13;10,0,6,14;10,0,6,15;10,1,7,0;10,1,7,1;10,2,7,2;10,9,7,3;10,9,7,4;10,2,7,5;10,4,7,6;10,9,7,7;10,3,7,8;10,0,7,9;10,0,7,10;10,2,7,11;10,9,7,12;10,2,7,13;10,0,7,14;10,0,7,15;10,0,8,0;10,0,8,1;10,2,8,2;10,3,8,3;10,3,8,4;10,2,8,5;10,9,8,6;10,9,8,7;10,2,8,8;10,0,8,9;10,0,8,10;10,1,8,11;10,1,8,12;10,1,8,13;10,0,8,14;10,0,8,15;10,0,9,0;10,0,9,1;10,1,9,2;10,9,9,3;10,1,9,4;10,1,9,5;10,2,9,6;10,2,9,7;10,1,9,8;10,1,9,9;10,1,9,10;10,1,9,11;10,0,9,12;10,1,9,13;10,1,9,14;10,1,9,15;10,0,10,0;10,0,10,1;10,2,10,2;10,2,10,3;10,2,10,4;10,1,10,5;10,1,10,6;10,1,10,7;10,1,10,8;10,2,10,9;10,9,10,10;10,1,10,11;10,0,10,12;10,1,10,13;10,9,10,14;10,1,10,15;10,0,11,0;10,1,11,1;10,2,11,2;10,9,11,3;10,3,11,4;10,3,11,5;10,9,11,6;10,1,11,7;10,1,11,8;10,9,11,9;10,2,11,10;10,1,11,11;10,0,11,12;10,1,11,13;10,1,11,14;10,1,11,15;10,0,12,0;10,2,12,1;10,9,12,2;10,4,12,3;10,9,12,4;10,9,12,5;10,4,12,6;10,3,12,7;10,2,12,8;10,1,12,9;10,1,12,10;10,0,12,11;10,0,12,12;10,0,12,13;10,0,12,14;10,0,12,15;10,0,13,0;10,2,13,1;10,9,13,2;10,4,13,3;10,3,13,4;10,4,13,5;10,9,13,6;10,9,13,7;10,1,13,8;10,0,13,9;10,0,13,10;10,0,13,11;10,0,13,12;10,1,13,13;10,1,13,14;10,1,13,15;10,0,14,0;10,1,14,1;10,1,14,2;10,2,14,3;10,9,14,4;10,2,14,5;10,2,14,6;10,2,14,7;10,1,14,8;10,0,14,9;10,0,14,10;10,0,14,11;10,0,14,12;10,1,14,13;10,9,14,14;10,1,14,15;10,0,15,0;10,0,15,1;10,0,15,2;10,1,15,3;10,1,15,4;10,1,15,5;10,0,15,6;10,0,15,7;10,0,15,8;10,0,15,9;10,0,15,10;10,0,15,11;10,0,15,12;10,1,15,13;10,1,15,14;10,1,15,15
```

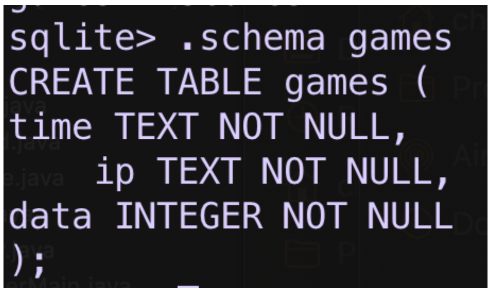
Connect to the database

- There are two tables in the **data.db** at the server side



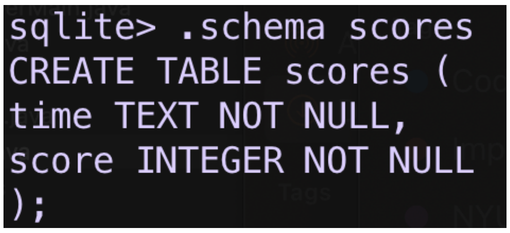
```
❯ sqlite3 ./Minesweeper/data.db
SQLite version 3.32.3 2020-06-18 14:16:19
Enter ".help" for usage hints.
sqlite> .tables
games   scores
sqlite>
```

- Table **games**



```
sqlite> .schema games
CREATE TABLE games (
time TEXT NOT NULL,
    ip TEXT NOT NULL,
data INTEGER NOT NULL
);
```

- Table **scores**



```
sqlite> .schema scores
CREATE TABLE scores (
time TEXT NOT NULL,
score INTEGER NOT NULL
);
```

- Only 7 the most recent game are saved in the table **games**
- Only five highest records are saved in the table **scores**
- Some SQL commands

```sql
-- create table scores
CREATE TABLE scores (
  time TEXT NOT NULL,
  score INTEGER NOT NULL
);

-- select top five scores
SELECT score from scores ORDER BY score DESC LIMIT 5;

-- delete line with smallest scores
DELETE FROM scores WHERE score = (SELECT MIN(score) FROM scores);

-- delete table scores
DROP TABLE scores;

-- create table games
CREATE TABLE games (
  time TEXT NOT NULL,
    ip TEXT NOT NULL,
  data INTEGER NOT NULL
);

-- delete table games
DROP TABLE games;
```

Other features

- Add the shortcuts to quickly execute the menu item

- Load the selected game. The user can find the desired game by the time stamp, hostname and IP