

Title

Elemental Brawlers

Topics Covered

Network Programming

Multi-Threaded Network Programming

Network Serialization

Introduction

For this assignment you are to create a multiplayer game where players can connect to a server to start games or join other games. You should make a server that accepts connections from incoming players, stores the current games and who is participating in them, and can handle sending game data between players. You will also need a client object that has all the logic for the game along with an object to handle communication between the thread functionalities and the server.

Assignment

For this assignment, you will be creating a game where players can create a team and battle them to win. First, you must store all the characters from which a player can choose. You will receive a JSON file with the relevant data for each character. This includes the **Name**, **Type**, **Stats**, **Abilities**, and **Ability Data**. A sample of the input JSON is below.

```
{
  "Brawlers" : [
    {
      "name" : "Flame Magician",
      "type" : "fire",
      "stats" : {
        "health" : "75",
        "attack" : "114",
        "defense" : "100",
        "speed" : 104
      },
      "abilities" : [
        {
          "name" : "flame burst",
          "type" : "fire",
          "strength" : "75"
        },
        {
          "name" : "magic flash",
          "type" : "lightning",
          "strength" : "60"
        }
      ]
    },
    {
      "name" : "Water Wrestler",
      "type" : "water",
```

```

    "stats" : {
        "health" : "100",
        "attack" : "100",
        "defense" : "90",
        "speed" : "60"
    },
    "abilities" : [
        {
            "name" : "wet willy",
            "type" : "water",
            "strength" : "90"
        },
        {
            "name" : "mud dive",
            "type" : "earth",
            "damage" : "75"
        }
    ]
}
]
}

```

Multiplayer Functionality

When the server is started, it should prompt the user for a JSON file from which to read the characters and a port to which to bind. You can assume you will receive a valid JSON file, but you must prompt the user if an invalid port is entered and request a valid one. The only condition that will make a port invalid is if the operating system does not allow the program to bind to it. Once successful, clients may start connecting to the server.

Sample Server:

```

Please enter a valid file:
assignment4.json

```

```

Please enter a valid port:
80

```

```

Invalid Port!
Please enter a valid port:
6789

```

```

Success!

```

The client must connect to the correct hostname/IP address and port. If a connection attempt is unsuccessful, notify the user that it was not successfully and prompt the user for the hostname/IP address and port. Once connected, the user will have the option to start a game or join a game.

Start Game: If the user wants to start a game, prompt him to give a name to the game. You must ensure that it is case-insensitive unique to all other existing games. If the name already exists, prompt the user for another name.

After the user enters a unique name, prompt him for the number of total players, either 1 or 2. Then the user will wait until all players have connected. When a player connects, it is announced to all connected players. Once two players have joined, the game will begin.

Join Game: Ask the user for the name of a game to join. If the game is already full or does not exist, inform the user and prompt for another game name. Otherwise, add the user to the game and inform the other player that a new player has joined.

Sample Client:

```
Please enter an IP address:  
notlocalhost
```

```
Please enter a port:  
6789
```

```
Unable to connect!  
Please enter an IP address:  
localhost
```

```
Please enter a port:  
80
```

```
Invalid port!  
Please enter a port:  
6789
```

```
Please make a choice:  
1) Start Game  
2) Join Game  
1
```

```
What will you name your game?  
alreadyExists
```

```
This game already exists!  
What will you name your game?  
newGame
```

```
How many players?  
1 or 2  
2
```

```
Waiting for players to connect...  
Player 2 connected!  
Starting game...
```

Game Structure: A player wins by defeating the other player's team. In a 1 player game, the player challenges the computer to a battle. The computer will be given an arbitrary team and should make random decisions for actions. In a 2-player game, the user will challenge another user to a battle.

Gameplay:

At the beginning each player will be shown a list of brawlers to choose from and must choose **3**. For testing purposes, you may want to start with a 1-on-1 battle, then scale it up. You must handle a user choosing an inappropriate amount of brawlers, and making invalid selections. They can choose a brawler more than once and different players can have the same brawlers. The players have their first brawler battle until one loses all its health. When that happens, the next character swaps in to replace it. Once a player loses all his brawlers he loses.

There are 5 types of characters in this game: **fire, earth, water, air, and lightning**. Types are important because some types can be strong against some and weak against others.

Battle Damage

Strong:

Water > Fire > Air > Earth > Lightning > Water

Weak:

Water < Lightning < Earth < Air < Fire < Water

Water type moves are effective against Fire brawlers and 2x multiplier
Fire type moves are not effective against Water brawlers 0.5x multiplier
If a move is neither strong nor weak, it does 1x multiplier.

In a battle, each player will choose a move. Once both players have chosen a move, the brawler with the higher speed stat will make their move first, if they have the same speed stat you can decide who goes randomly.

If damage exceeds the remaining health of a brawler, then the move only does damage equal to the remaining health.

To calculate the damage of a move you will need to know the **ability type, ability power**, attacking brawler's **attack stat**, defending brawler's **defense stat**, and the **effectiveness** of the move. If a brawler is defeated before it can make a move, then the move is not performed and the next brawler is sent out.

The formula to calculate damage:

$((\text{attackStat} * (\text{ability damage} / \text{defenseStat})) / 5) * (\text{effectiveness multiplier})$ rounded-down

2-player sample (alignment added)

Choose 3 Brawlers:

- 1) Flame Magician
 - 2) Water Wrestler
 - 3) Thunder Thumper
- 2,3,4

Invalid!

Choose 3 Brawlers:

- 1) Flame Magician
 - 2) Water Wrestler
 - 3) Thunder Thumper
- 2,3,1

Excellent!

You send Water Wrestler!
Your opponent plays Thunder Thumper!

Choose a move:

- 1) wet willy, water, 90
 - 2) mud dive, earth, 75
- 2

Thunder Thumper used static shock!
It was super effective!
It did 39 damage!
Water Wrestler used mud dive!
It was super effective!
It did 40 damage!

Water Wrestler has 61 health.

Choose a move:

- 1) wet willy, water, 90
 - 2) mud dive, earth, 75
- 1

Thunder Thumper used ballistic belch!
It did 14 damage!
Water Wrestler used wet willy!
It was not very effective!
It did 12 damage!

Water Wrestler has 47 health

Choose a move:

- 1) wet willy, water, 90
 - 2) mud dive, earth, 75
- 2

Thunder Thumper used static shock!
It was super effective!
It did 39 damage!
Water Wrestler used mud dive!
It was super effective!

Choose 3 Brawlers:

- 1) Flame Magician
 - 2) Water Wrestler
 - 3) Thunder Thumper
- 3,1,2

Excellent!

You send Thunder Thumper!
Your opponent plays Water Wrestler!

Choose a move:

- 1) static shock, lightning, 80
 - 2) ballistic belch, air, 65
- 1

Thunder Thumper used static shock!
It was super effective!
It did 39 damage!
Water Wrestler used mud dive!
It was super effective!
It did 40 damage!

Thunder Thumper has 39 health.

Choose a move:

- 1) static shock, lightning, 80
 - 2) ballistic belch, air, 65
- 2

Thunder Thumper used ballistic belch!
It did 14 damage!
Water Wrestler used wet willy!
It was not very effective!
It did 12 damage!

Thunder Thumper has 27 health

Choose a move:

- 1) static shock, lightning, 80
 - 2) ballistic belch, air, 65
- 1

Thunder Thumper used static shock!
It was super effective!
It did 39 damage!
Water Wrestler used mud dive!
It was super effective!

It did 40 damage!

Water Wrestler has 8 health!

Thunder Thumper was defeated!
Your opponent sent out Flame Magician!

Choose a move:

- 1) wet willy, water, 90
- 2) mud dive, earth, 75

1

Flame magician used flame burst!
It was not very effective!
It did 14 damage!

Flame Magician has 75 health!

Water Wrestler was defeated!
You sent out Thunder Thumper!

Choose a move:

- 1) static shock, lightning, 80
- 2) ballistic belch, air, 65

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 22 damage!

Thunder Thumper has 52 health!

Choose a move:

- 1) static shock, lightning, 80
- 2) ballistic belch, air, 65

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 22 damage!

Thunder Thumper has 30 health!

Choose a move:

- 1) static shock, lightning, 80
- 2) ballistic belch, air, 65

1

It did 40 damage!

Thunder Thumper was defeated!
You sent out Flame Magician!

Choose a move:

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

1

Flame magician used flame burst!
It was not very effective!
It did 14 damage!

Flame Magician has 75 health!

Water Wrestler was defeated!
Your opponent sent out Thunder Thumper!

Choose a move:

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 22 damage!

Flame Magician has 58 health!

Choose a move:

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 22 damage!

Flame Magician has 41 health!

Choose a move:

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 22 damage!

Thunder Thumper has 8 health

Choose a move:

- 1) static shock, lightning, 80
- 2) ballistic belch, air, 65

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 8 damage!

Thunder Thumper was defeated!
You sent out Flame Magician!

Choose a move:

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

2

Flame Magician used magic flash!
It did 8 damage!

Flame Magician was defeated
Your opponent sent out Water Wrestler!

Choose a move;

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

1

Flame Magician used flame burst!
It was not very effective!
It did 9 damage!
Water Wrestler used mud dive!
It did 15 damage!

Flame Magician has 60 health!

Choose a move;

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

2

Flame Magician used magic flash!
It was super effective!
It did 30 damage!
Water Wrestler used wet willy!

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 22 damage!

Flame Magician has 24 health

Choose a move:

- 1) flame burst, fire, 75
- 2) magic flash, lightning, 60

1

Thunder Thumper used static shock!
It did 17 damage!
Flame Magician used flame burst!
It did 8 damage!

Flame Magician has 7 health!

Thunder Thumper was defeated!
Your opponent sent out Flame Magician!

Choose a move:

- 1) flame burst
- 2) magic flash

1

Flame Magician used magic flash!
It did 7 damage!

Flame Magician was defeated
You sent out Water Wrestler!

Choose a move:

- 1) wet willy, water, 90
- 2) mud dive, earth, 75

2

Flame Magician used flame burst!
It was not very effective!
It did 9 damage!
Water Wrestler used mud dive!
It did 15 damage!

Water Wrestler has 91 health!

Choose a move:

- 1) wet willy, water, 90
- 2) mud dive, earth, 75

1

Flame Magician used magic flash!
It was super effective!
It did 30 damage!
Water Wrestler used wet willy!

It was super effective!
It did 36 damage!

Flame Magician has 24 health!

Choose a move:

- 1) flame burst, fire, 75
 - 2) magic flash, lightning, 60
- 2

Flame Magician used magic flash!
It was super effective!
It did 30 damage!
Water Wrestler used wet willy!
It was super effective!
It did 24 damage!

Flame Magician was defeated!
You are out of brawlers!

You Lose!

It was super effective!
It did 36 damage!

Water Wrestler has 61 health!

Choose a move:

- 1) wet willy, water, 90
 - 2) mud dive, earth, 75
- 1

Flame Magician used magic flash!
It was super effective!
It did 30 damage!
Water Wrestler used wet willy!
It was super effective!
It did 24 damage!

Water Wrestler has 31 health!

Flame Magician was defeated!
Your opponent is out of brawlers!

You Win!

Grading criteria (4.5%)

Starting Server (0.5%)

- 0.2% - JSON is read and brawler data is stored correctly
- 0.2% - Port binding and error handling are implemented
- 0.1% - Server accepts connections

Connecting Client (2.3%)

- 0.1% - Invalid port numbers are handled
- 0.2% - Socket timeout for failed connection is handled
- 1.0% - Starting a game
- 1.0% - Joining a game

Game Logic (1.7%)

- 0.2% - Brawler selection
- 0.5% - Single-player battle functionality
- 1.0% - Battle logic implementation