

Computer-Based Solution for Scrabble

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Submission date: 01-Dec-2023 07:53AM (UTC+0000)

Submission ID: 217471933

File name: 49306_Tariq_Dewat_Computer-Based_Solution_for_Scrabble_543034_1563650759.docx (26.52K)

Word count: 2407

Character count: 15599

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Analysing & Solving Problems

Computing (Software Engineering) – Foundation

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1.Introduction

1.1 Overview of Scrabble

Scrabble, a popular board game beloved by people, over the world flawlessly brings together language skills and strategic thinking. Created in 1938 by Alfred Mosher Butts it continues to captivate players with its blend of wordplay and tactical gameplay. The primary objective of the game is to accumulate points by forming words on a 15x15 grid. Each letter tile has an assigned point value; common letters like 'E' and 'A' have scores while common ones, like 'Q' and 'Z' have higher scores(TIME.com, 2008; Encyclopedia.com, n.d).

According to the author the popularity of the Scrabble game stems from it is ability to provide a game that's both straightforward and significant. It appeals to individuals of all ages and skill levels making it a popular choice, for environments and family get togethers additionally engaging in a game of Scrabble aids in the development of skills, such, as problem solving and reasoning (Magazine, 2019).

1.2 Rules of Scrabble

Scrabble although straightforward offers opportunities, for moves. At the beginning of each game players select seven tiles from a pool of 100. During their turn players form words on the board in a crossword manner. The first word must intersect with the centre square and subsequent words must connect to existing words, on the board *Scrabble Rules (How to Play, Points, Scoring & Strategy, 2023)*.

In the ways scoring system, in Scrabble relies on the values assigned to each letter and the special squares on the board. These squares have the ability to double or triple the worth of a letter or word. When playing Scrabble it's not about knowing words; players also need to think about where they place their tiles to maximize their points while minimizing chances, for their opponent. The game ends when all the tiles have been drawn and a player uses their tile or when there are no possible moves. The winner is determined by whoever has the score taking into account any tiles that haven't been played yet. With its rules and the need, for thinking Scrabble is a game that's both easy to pick up and difficult to become a master at (Nations,2020).

2:MoSCoW Method for Requirements Analysis

2.1 Introduction to MoSCoW Method:

The MoSCoW technique is a requirement prioritisation tool used in project management and software development., and It is an abbreviation for Must have, Should have, Could have, and Won't have significantly orders This strategy guarantees that the most critical components of a project are addressed first, ensuring focus and optimal resource utilisation, So when we comes to software development for games like Scrabble, the MoSCoW technique play significant role in distinguishing between elements required for game operation and those that improve user experience. Developers can effectively spend time to ensuring that the essential aspects of the product are working before introducing features (MOSCOW Prioritization, 2022 ;Brush,2023).

2.2 Applying MoSCoW to Scrabble

2.2.1 Must Have

A Scrabble game software should include features that're necessary, for a smooth gameplay experience. These features consist of a game board with the layout, a tile management system that enables players to draw, shuffle and play tiles and a scoring mechanism that calculates points based on the value of words and their placement on the board. Furthermore it is important to have an AI, for single player mode and a turn management system to ensure gameplay (Ltd, 2023).

2.2.2 Should Have

The "Should Have" category improves the game experience. It is not essential, for basic functionality. Advanced AI levels provide challenges to engage players. With multiplayer functionality human players can compete against each other and the game history feature allows players to review their moves. The save and resume function offers convenience by allowing players to continue their games at a time (AI In Human-computer Gaming: Techniques, Challenges and Opportunities, n.d.).

2.2.3 Could Have

The additional features of Could Have bring improvements to the game. These consist of a chat feature that allows players to communicate with each other and tiles for a unique gaming experience and player profiles that keep track of individual statistics (network diversity) ,so Having language options would make the game more accessible, to those who don't speak English (Jung, 2020).

2.2.4 Won't Have

In the version we have identified some features that are not deemed crucial and have been labelled as "Won't Have." These include real time online multiplayer, voice command functionality and video streaming integration. Although these features could bring benefits they are not essential, for the release of the software (Technologies, 2023).

3: Designing the Computer-Based Solution

3.1 System Architecture

When creating a solution, for Scrabble it's important to consider the design of the system. The structure should be designed in a way that effectively handles elements such as game logic, artificial intelligence and the user interface. So To enable multiplayer functionality it is suggested to use a client server model. In this setup the server would be responsible, for managing the game logic while client applications would handle the user interface (Ltd,2023).

When we comes to technology using HTML5 and JavaScript code on the client side ensures that the game can be easily accessed via web browsers. It's compatible, with a range of devices. On the server side Node.js is an option for managing multiplayer game states and real time updates. For instance player data and game histories can be stored in a database like MySQL to ensure that the game architecture supports platforms, such as desktop and mobile. This way design ideas need to be

incorporated to allow the game interface to adapt to screen sizes and resolutions like, in a Scrabble game (Backshoot, 2021).

3.2 User Interface Design

Creating an engaging user interface (UI) is crucial when it comes to captivating and retaining players. The UI should be designed to be user friendly resembling the Scrabble board to ensure a transition, into gameplay. This includes providing a representation of the game board tile rack and score. Moreover it is important to incorporate accessibility features such as contrast modes and adjustable text size in order to accommodate players with impairments (Alice, 2023) and Van Welie, 2022).

Apart from the gameplay interface the UI should also offer navigation to other features like game history, player statistics and settings.

The design should strike a balance, between aesthetics and functionality so that the visual elements do not overshadow the playability of the game (How to Make a Digital Board Game: A Guideline to Start With, 2023).

3.3 AI Implementation

Implementing intelligence (AI), in Scrabble presents challenges due to the linguistic nature of the game. The AI not needs to comprehend words but also strategize for optimal scoring opportunities and defensive moves. Different levels of AI cater to players with varying skill levels ranging from beginners to players (Young, 2018.)

A basic AI can employ an algorithm that focuses on word validity and basic scoring principles. On the hand advanced AI would involve sophisticated algorithms that incorporate strategic elements, such, as blocking crucial board positions and maximizing the use of high value tiles. Machine learning techniques can be utilized to develop an AI that adapts to the players skill level by learning from each game offering a match (Ramdurai, 2020; Hamdi, 2023).

4: Challenges and Considerations

4.1 Technical Challenges:

Designing a version of Scrabble comes with its share of technical hurdles. One major aspect is the development of AI that strikes a balance, between keeping players engaged and maintaining fairness and unpredictability. This involves implementing algorithms and possibly utilizing machine learning techniques, which can be quite demanding in terms of resources. Another significant challenge lies in optimizing performance for online multiplayer scenarios. The software needs to handle games simultaneously ensuring minimal delays for players. This requires utilization of server resources and robust network communication. Furthermore achieving compatibility across platforms adds another layer of complexity. The game must perform reliably on devices and operating systems, necessitating testing and potentially requiring tailored development strategies, for each platform (Sophia, 2023).

4.2 Ethical and Social Considerations

When it comes to the world fairness is of importance. The software needs to have features, in place that prevent cheating like making sure players can't use tools to find words or manipulate the games code. It's crucial to update and monitor the game to ensure its integrity (Nyfa, 2022).

Protecting data privacy is a concern in multiplayer modes where player profiles and online interactions come into play. The software should adhere to data protection regulations ensuring that player data is stored securely and used ethically (Data Privacy and Online Gaming: Why Gamers Make for Ideal Targets, 2015.)

From a standpoint it's important for the game to promote inclusivity. This means not offering language options but also considering the needs of players with disabilities. Additionally fostering a community is essential, by providing guidelines and tools that manage player interactions and prevent any form of harassment or inappropriate (behavior.Able Gamers, 2023).

5-Variables Identification

1. The game board, represented by a 2D array stores information, about the tiles placed on the Scrabble board. Each element in the array includes details like the letter and any score multipliers, such as word score.
2. The tile bag is an array that holds all the tiles not currently being used by players. It contains both the letter and point value for each tile.
3. The player tiles are stored in an array of arrays where each element represents a players set of tiles.
4. Player scores are tracked using an array of integers. Each element corresponds to a players score.
5. Constants include;

BOARD_SIZE which is an integer representing the dimension of the game board (15 for a 15x15 board).

TILE VALUES which is a mapping each letter, to its corresponding point value.

6-pseudocode for Scrabble

1. Begin the Game;

START_GAME(): Begins the game process.

2. Set up the game and Tiles;

INITIALIZE_GAME(): Sets up the game.

create Empty Board(): Creates an empty game board.

Establish Tiles(): Prepares the tiles used in the game.

Establish Player Scores(): Sets up a scoring system for the players.

3. Player Turn Loop:

WHILE game is not over: turn the game until a specified end condition is met.

FOR EACH player IN players: Loops through each player for their turn.

draw Tiles(tile Bag): Players draw tiles from the tile bag.

get Player Action(): Determines whether the player will place a word or exchange tiles.

IF action is Place Word: Checks if the player's action is to place a word.

validate Word (word, game Board): Validates the word against the game's rules.

place Word On Board(word, game Board): Places the valid word on the board.

calculate Score(word): Calculates the score for the placed word.

update Player Score(player Scores, player, score): Updates the player's score.

notify Invalid Word(): Notifies the player if the word is invalid.

ELSE IF action is Exchange Tiles: Checks if the player chooses to exchange tiles.

return Tiles To Bag(tile Bag, exchanged Tiles): Returns the exchanged tiles to the bag.

draw Tiles(tile Bag): Draws new tiles for the player.

4. Checking End Game Conditions:

IF no Tiles Left(tile Bag) THEN break: Ends the game if there are no tiles left.

IF no Moves Possible(game Board) OR no Tiles Left(tile Bag): Checks for game-ending conditions.

5. Calculate Final Scores:

FOR EACH player IN players: Loops through each player.

calculate Penalty(player): Calculates any penalties.

update Player Score(player Scores, player, final Score): Updates the final score.

6. Declare Winner:

find Player With Highest Score(player Scores): Identifies the winner.

declare Winner(winner): Declares the winning player.

7.end Game:

END_GAME(): Concludes the game process.

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GRADEMARK REPORT

FINAL GRADE

75/100

GENERAL COMMENTS

Work is of a good standard with clear knowledge and understanding of topic illustrated - with good logical approaches to solutions presented. Well done.

Document is well formatted with extensive use of references in relation to breakdown of rules.

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