

Analysing and Solving Problems

by Jordan Stewart

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Scrabble Algorithm

1 Student Name: Jordan Stewart

Student ID Number: 2209409

Module Name: Analysing and Solving Problems

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Lecturer's Name: Aliyu Sambo

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University: University of Wales

Campus: Birmingham City Campus

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Task 1

Introduction

Investigating Scrabble and offering a computer-based substitute are the goals of this work. With the use of letter tiles and a square board, players of the popular word game Scrabble create words. As technology develops, there is an increasing desire for digitally playable computer versions of popular board games like Scrabble.

To help you fully understand how Scrabble is played, we'll examine its rules and mechanics in this report. Additionally, we will rank and list the crucial elements of a computer-based solution using the MoSCoW prioritising technique. By categorising the requirements into "Must-Have," "Should-Have," "Could-Have," and "Won't-Have," we can identify the essential elements of the digital Scrabble implementation.

An entertaining and user-friendly computer-based Scrabble game will be designed and developed using the analysis and prioritising of demands as a guide. [1]We anticipate that the publication of this study will positively impact the creation of a fantastic digital Scrabble replacement that makes advantage of computer-based platforms while preserving the core elements of the original game.

At the conclusion of this report, the prerequisites for a computer-based solution, the relative importance of each feature category, and the Scrabble guidelines will all be clear. This data will serve as the foundation for developing an entertaining online Scrabble game for players of all skill levels.

1.1 Rules of Scrabble

Scrabble is a famous word game that has drawn players from all around the world for decades. It involves creating words out of letter tiles and strategically placing them on a play board to score points. Let's look at the Scrabble rules in more detail:

1. **Setup:**

- Scrabble is usually played by two to four people, however additional sets of tiles can be used to accommodate more people.
- To begin the game, each player selects seven letter tiles from the tile bag. The tiles stay facedown and consequently unseen to the other players.
- [2]The game board is a 15x15 square grid, providing you 225 squares to place tiles in.

2. **Word Placement:**

- Players take turns forming words on the game board, beginning with the first player and proceeding clockwise.
- The first word must be placed on the central star square, which serves as an anchor point for all subsequent words.
- Each word played must connect to another word on the board in a crossword-like pattern, either horizontally or vertically.
- As long as all words formed are valid, players can extend old words, create new words, and even construct several words with a single play.

3. **Valid Words:**

- All words used in Scrabble must be valid English terms listed in a standard dictionary to ensure fair play.
- In plays, proper nouns, abbreviations, prefixes, and suffixes are not permitted.
- If a challenge is issued, the player whose word is being questioned must define the term. If the word is proven to be incorrect, the challenger's turn is forfeited.

4. **Scoring:**

- Each letter tile in Scrabble has a point value printed on it.
- The score of each word is determined by adding the point values of its individual letters.
- [3]Some gaming board squares boost scoring possibilities by awarding extra points for entire words or tiles:
 - Double points (DL) will be awarded to the letter that is inserted into this square.

- Triple Letter Score (TL): The letter that is positioned in this square earns three times as many points.
- Double Word Score (DW): The score for the word as a whole is doubled if any of the word's letters are positioned on this square.
- Triple Word Score (TW): The score for the word as a whole is tripled if any of the letters are located on this square.
- One word might occur on numerous premium squares, boosting your score significantly.

5. **Turn Sequence:**

- Players build words on the board in turns. Turns are taken clockwise, starting with the first player and going around the table.
- Each player's turn entails forming a word, calculating their score, and updating their score on a score pad.
- The game proceeds in this manner until one of the end circumstances is met.

6. **Rack Management:**

- Players must restock their racks with enough tiles each turn to hold seven tiles. Players grab as many tiles as they can from the tile bag if there are fewer tiles than are required.
- Players also have the option of replacing all or a portion of their current tiles with fresh ones from the tile bag. They must draw an equivalent number of fresh tiles to take their position after returning the undesirable tiles to the bag.
- Changing tiles may be a smart decision when presented with a challenging letter combination.

7. **Game End:**

- The game goes on until either of the following happens:
- When a player completes a "bingo," which calls for using all of their tiles, they are awarded an extra 50 points.
- There are no more legal plays to be made because the tile bag is empty.
- The player with the highest score is deemed the victor if one of these criteria is satisfied.

[4]The rules of Scrabble find the ideal mix between linguistic skill and strategic thought, making the game difficult and fun for players of all ages. The game is a timeless and lasting classic in the world of board games because it promotes vocabulary growth, critical thinking, and friendly competition.

1.2 Requirement Features List

Must-Have:

1. **Core Gameplay:**

- Allow users to arrange letter tiles to create words on a virtual game board.
- Make use of the opportunity to connect recently introduced words to concepts that are already written on the board.
 - Use a popular dictionary to verify the correctness of the terminology.
 - Apply additional points and tile values based on the position on the board.

2. **User Interface:**

- Provide a straightforward and eye-catching user interface for the game board.
 - Ensure that the point totals for the letter tiles are shown.
 - Allow for easy tile insertion and manipulation on the board.

3. **Player Interaction:**

- Allow several participants to participate in turn-based activities.
- Provide a method for recording and displaying each player's score.

4. **Game Options:**

- Let players select their preferred language for word verification.

- Provide instructions or a help section that explains the rules and mechanics of the game.

Should-Have:

1. Multiplayer Functionality:

- Allow online multiplayer so that competitors may compete from a distance.
- Provide matching and lobby features so users may find opponents.
- Enable real-time synchronisation between players' games.

2. Customization:

- Allow for the modification of game parameters (such as deadlines and difficulty levels).
- Allow players to change the game's aesthetic components, such as the board themes or tile patterns.

3. Rack Management:

- Give players the option of replacing their current tiles with fresh ones from the tile bag.

Could-Have:

1. AI Opponents:

- Offer a single-player option with a range of challenging computer-controlled foe.

2. Chat Functionality:

- So that players may communicate with one another while playing, provide a chat option.

Won't-Have (at least for now):

1. Advanced AI:

- Employ a cutting-edge AI that can compete fiercely.

2. **Additional Languages:**

- Support languages other than the main one you've selected.

3. **Accessibility:**

- Include specific accessibility tools for players with visual or physical impairments.

4. **In-Game Purchases:**

- Permit virtual or real money purchases throughout the game.

1.3 Implement Under Must and Priorities

1. **Core Gameplay:**

Priority: High

Explanation:

The gameplay mechanics are the essential elements of the Scrabble game. The game cannot operate as designed without these crucial elements. Players must be able to link new words to existing ones, check the validity of terms using a standard dictionary, and earn points based on the worth of the tiles and bonus squares in order to construct words

by placing letter tiles on the board. Since it guarantees the fundamental operation of the game, the implementation of the core gameplay is the most important need.

2. **User Interface:**

Priority: High

Explanation:

Strong user interfaces are essential for games like Scrabble and other online ones. For a seamless and engaging playing experience, the gaming board interface must be easy to use and aesthetically appealing. So that players may make educated judgements and comprehend the present status of the game, the letter tiles, their point values, and the remaining tiles in the bag are all prominently displayed. It is a top priority need since a simple and understandable user interface considerably increases player happiness and engagement.

3. **Player Interaction:**

Priority: Medium

Explanation:

[5] A multiplayer, turn-based experience must include elements that permit player engagement. Features like the ability to skip rounds or trade tiles, track and show each player's score, and allow several players to take turns clockwise are also incorporated to increase the game's strategic complexity and promote player competitiveness. Even though player touch is essential for multiplayer, the game may still be played alone with less intense competition. However, the inclusion of multiplayer enhances the game's appeal and replay value overall.

Task 2

2.1 Variables

1. board:

This variable will serve as a representation of the game board and will be a 2D array to hold the letters that players have placed in each square of the board. In order to correspond to a standard Scrabble board, the size will be 15x15.

2. tile_bag:

This variable will hold the number of letter tiles that are still available for players to draw at any one time over the course of the game. Either a list or a stack will be utilised as the data structure to keep track of the tiles and their quantities.

3. players:

A list of player objects, each of which represents a participant in the game, will be recorded in this variable. Each player item will have a name, score, and rack, among other characteristics.

4. current_player:

This variable will reflect the player who is currently in the lead. The reference or index of the player who is currently picked in the list of players will be retained.

5. letter_values:

This variable will be a dictionary that associates a point value with each letter tile. It will be a constant dictionary because the point values of the letters stay the same during the entire game.

6. bonus_squares:

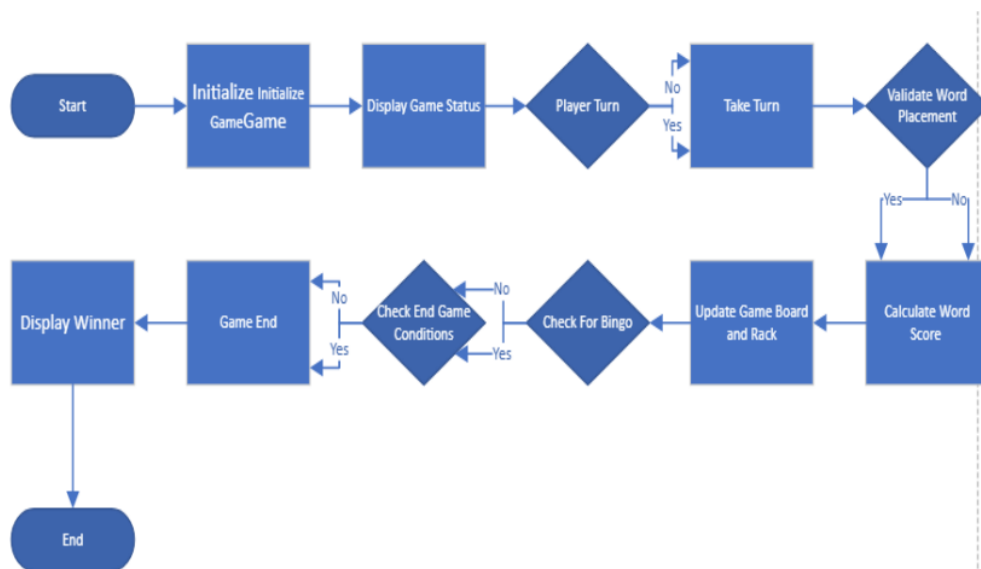
The position and kind of bonus squares (such as double letters, triple words, etc.) on the game board will be shown by this variable. Each square's coordinates and bonus type can be kept in a constant list or a dictionary, respectively.

7. valid_words_dict:

An alphabetical list of legal English terms will be kept in this variable. Either an online dictionary API or an external file can be used to load it. Because the acceptable terms remain the same throughout the game, this vocabulary will remain consistent.

8. **player_rack_size:**
This fixed variable (typically 7 tiles) determines the maximum number of letter tiles a player may hold in their rack at any given moment.
9. **end_game_conditions:**
This variable will serve as a representation of these events, such as when a player uses all of their available tiles or when the tile bag is empty. Either a constant list or a dictionary can be used to provide the criteria.
10. **turn_limit:**
This constant variable will set the length of each player's turn. If a player exceeds this time limit, their turn is skipped.

2.2 Flowchart



2.3 Pseudo Code

Take Turn Sub-Process:

```
Function takeTurn(player):
    // Display the game board, player scores, and current player's rack
    DisplayGameStatus()

    // Player forms a word using tiles from their rack
    word = GetPlayerWordFromRack(player)

    // Validate if the word can be placed on the board and connects to existing
    words
    if IsValidWordPlacement(word):
        // Calculate the word score based on letter values and bonus squares
        wordScore = CalculateWordScore(word)

        1 // Update the game board with the placed word
        UpdateGameBoard(word)

        // Remove used tiles from the player's rack
        RemoveTilesFromRack(player, word)

        // Refill the player's rack with new tiles from the tile bag
        RefillRack(player)

        // Update the player's score with the word score
        player.score += wordScore

        // Check if the player used all their tiles (Bingo)
        if IsBingo(word):
            player.score += 50
        else:
            // Invalid word placement, prompt the player to try again
            DisplayMessage("Invalid word placement. Try again.")
            takeTurn(player)
```

```
    end if
End Function
```

Calculate Word Score Sub-Process:

```
Function CalculateWordScore(word):
    wordScore = 0
    for each letter in word:
        // Get the point value of the letter from the letter_values dictionary
        letterScore = letter_values[letter]

        // Check if the letter is placed on a bonus square (Double Letter Score or
        Triple Letter Score)
        if IsLetterOnBonusSquare(letterPosition):
            // Double the letter's score if on a Double Letter Score square
            if IsDoubleLetterScoreSquare(letterPosition):
                letterScore *= 2
            // Triple the letter's score if on a Triple Letter Score square
            else if IsTripleLetterScoreSquare(letterPosition):
                letterScore *= 3
            end if
        end if

        // Add the letter's score to the total word score
        wordScore += letterScore
    end for

    // Check if the entire word is placed on a bonus square (Double Word Score or
    Triple Word Score)
    if IsWordOnBonusSquare(word):
        // Double the word's score if on a Double Word Score square
        if IsDoubleWordScoreSquare(wordPosition):
            wordScore *= 2
        // Triple the word's score if on a Triple Word Score square
        else if IsTripleWordScoreSquare(wordPosition):
            wordScore *= 3
        end if
    end if

    return wordScore
End Function
```

References

- [1] Zook, A., Harrison, B. and Riedl, M.O., 2019. Monte-carlo tree search for simulation-based strategy analysis. *arXiv preprint arXiv:1908.01423*.
- [2] Kobzeva, N., 2015. Scrabble as a tool for engineering students' critical thinking skills development. *Procedia Social and Behavioral Sciences*, 182, pp.369-374.
- [3] Richards, M. and Amir, E., 2007, January. Opponent Modeling in Scrabble. In *IJCAI* (pp. 1482-1482).
- [4] Onasanya, T.O., Aladesusi, G.A. and Onasanya, S.A., 2021. EFFECT OF SCRABBLE GAME ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENTS IN SELECTED ENGLISH LANGUAGE CONCEPTS IN ILORIN METROPOLIS. *Indonesian Journal of Learning and Instruction*, 4(2).
- [5] Aung, H.P.P., Khalid, M.N.A. and Iida, H., 2021. What Constitutes Fairness in Games? A Case Study with Scrabble. *Information*, 12(9), p.352.

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