Project Title: Advanced Scrabble AI

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Course: AI
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. Project Overview

● Project Topic:
This project focuses on enhancing the traditional Scrabble game by integrating advanced AI capabilities and introducing new gameplay elements such as power tiles and a hexagonal board layout. The AI will be capable of strategic word placement, blocking opponents, and maximizing score through intelligent move selection.

● Objective:

- Develop an AI using the **Minimax algorithm with Alpha-Beta Pruning*** to play Scrabble competitively.
- Create a variant with new rules, such as power tiles or a hexagonal board, to increase complexity and strategy.
- Implement heuristics to evaluate board control, word length, and point maximization.

2. Game Description

● Original Game Background:
Scrabble is a word-based board game where players form words using letter tiles on a 15x15 grid. Words must connect with existing ones and are scored based on letter values and premium squares.

● Innovations Introduced*:

- **Hexagonal Board Layout:** Increases word placement possibilities and complexity.
- **Power Tiles:** Special tiles with effects like double turn, wildcard letters, or blocking tiles.
- **Dynamic Objectives:** Secret missions for bonus points, like forming a 7-letter word.

*tentative and are subject to change based on feasibility

3. AI Approach and Methodology

● AI Techniques potentially applicable:

- **Minimax Algorithm:** For evaluating moves based on score potential and blocking opponents.
- **Alpha-Beta Pruning:** To optimize move search efficiency.
- **Other Techniques:** Neural networks for word predictions and decision-making.

● Heuristic Design:

- Prioritize high-value letters on premium squares.
- Control board center and block high-scoring spots.

● Complexity Analysis:

- **Time Complexity:** Depends on board size and move depth.
- **Challenges:** Efficient management of a large dictionary for word validation.

*The proposal is subject to changes due to course content coverage

4. Game Rules and Mechanics

● Modified Rules:

- Special power tiles with effects like extra turns or wildcard letters.
- Dynamic objectives for secret missions and bonus points.

● Winning Conditions:

- Traditional highest-score wins or completing secret missions for additional victory paths.

● Turn Sequence:

- Similar to traditional Scrabble but with power tiles influencing turn outcomes.

5. Implementation Plan

● **Programming Language:** Python
● **Libraries and Tools:**

- **Pygame/JavaScript:** For GUI.
- **NumPy/Pandas:** For data handling.
- **NLTK/Tensorflow:** For dictionary management and word validation.

● **Milestones and Timeline:**

- **Week 1-2:** Game design and rule finalization.
- **Week 3-4:** AI strategy development (Minimax and heuristics).
- **Week 5-6:** Coding and testing the game mechanics.
- **Week 7:** AI integration and testing.
- **Week 8:** Final testing and report preparation.

6. References

- To be added based on sources consulted.