**Assignment 1**

**Applied Artificial Intelligence**

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**Submitted To:**

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**Word Ladder Game Report**

**Introduction**  
This program is a word transformation game. The goal is to change one word into another by changing one letter at a time. Each new word must be a valid word from the list. The game includes different modes such as a simple challenge, a challenge mode with banned words, and a multiplayer mode. The program also provides AI assistance using different search algorithms.

**Steps Involved in the Program**

1. **Reading and Setting Up Words**
   * The program reads words from a file named words.txt.
   * It then filters the words based on the chosen difficulty. For example, basic mode uses 3-letter words, while advanced mode uses 5-letter words.
   * The setup\_words function goes through the list and selects only those words that match the chosen length.
2. **Creating the Word Graph**
   * A graph is built where each word is a node.
   * Two words (nodes) are connected if they differ by exactly one letter.
   * The function check is used to see if two words differ by one letter, and createGraph builds the entire graph.
3. **Search Algorithms for AI Assistance**
   * **Breadth-First Search (BFS):**  
     Finds a transformation path from the start word to the target word by exploring all possible moves level by level.
   * **Uniform Cost Search (UCS):**  
     Finds the shortest path by using a priority queue to always expand the lowest-cost path first.
   * *A Search*\*:   
     Enhances the search by using a heuristic that estimates how many letters are different between the current word and the target. The formula used is:

f(n)=g(n)+h(n)

where g(n) is the number of moves so far, and h(n) is the number of letter differences.

1. **Game Modes and User Interaction**
   * **Simple Challenge Mode:**  
     The game selects two random words (start and target) and displays a possible transformation path. The user makes moves to transform the word.
   * **Challenge Mode:**  
     Similar to the simple mode but with a limited number of moves and banned words that cannot be used.
   * **Multiplayer Mode:**  
     Two players take turns trying to transform the word. Each player’s score and moves are tracked.
2. **AI Assistance**
   * At any point, the player can request help from the computer.
   * The program offers a choice between the three search algorithms (BFS, UCS, A\*).
   * When an algorithm is selected, it calculates the next move to help guide the player.
3. **Graph Visualization**
   * The program uses **NetworkX** and **Matplotlib** to create a visual representation of the word graph.
   * When the user opts in, the visualize\_graph function draws the graph, showing nodes (words) and edges (connections between words that differ by one letter).

**Results Obtained**

* **Gameplay:**  
  The game successfully allows players to transform words using one-letter changes while tracking score and moves.
* **Search Algorithms:**  
  The program shows how different search algorithms (BFS, UCS, and A\*) can find transformation paths from a starting word to a target word.
* **Graph Visualization:**  
  Users can see the word transformation graph, which helps in understanding how words are connected.
* **Multiple Game Modes:**  
  The program supports various game modes, including a challenge mode with obstacles and a multiplayer mode for live competition.