DAA MINI PROJECT

TITLE:

Cryptarithmetic Puzzle Solver using Branch and Bound.

OBJECTIVE:

This mini-project aims to solve cryptarithmetic puzzles, such as the famous SEND + MORE = MONEY puzzle, using the Branch and Bound technique. Each letter in the puzzle represents a unique digit, and the goal is to find a digit assignment that satisfies the equation. The project demonstrates how efficient search techniques can solve these puzzles by reducing computational overhead compared to brute-force methods.

IMPLEMENTATION LANGUAGE:

The project is implemented in **C++**, utilizing recursion, backtracking, and state-space pruning to solve cryptarithmetic puzzles efficiently. C++ is chosen for its efficiency in handling recursion and backtracking.

HOW BRANCH AND BOUND TECHNIQUE IS APPLIED:

The Branch and Bound technique is applied by treating the solution space as a tree of possible digit assignments. Here's how it's implemented:

1. **Branching:** Each branch represents a partial assignment of digits to letters in the equation. The algorithm recursively assigns digits to letters until the entire equation is satisfied.
2. **Bounding:** At each step, the algorithm checks if the current assignment violates any arithmetic rules (e.g., duplicate digits or incorrect sum). If so, that branch is pruned and does not explore further.
3. **State-Space Pruning:** Invalid or unpromising branches are eliminated early. If a partial solution contradicts any constraints (like repeated digits), the algorithm backtracks, trying different possibilities.
4. **Backtracking:** If a digit assignment leads to an invalid state, the algorithm backtracks to the previous step and tries another digit, continuing until a valid solution is found.

CONCLUSION:

This project showcases how the Branch and Bound technique can efficiently solve cryptarithmetic puzzles by pruning invalid branches and reducing unnecessary computations. The approach ensures scalability for more complex puzzles while offering a practical solution to constraint satisfaction problems.

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