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AIES

Assignment 3

Aim: Solve constraint satisfaction problem like SEND + MORE = MONEY

Objective: To solve constraint satisfaction problem like SEND + MORE = MONEY

Theory:

Constraint Satisfaction Method: It is a problem-solving technique that plays a crucial role in various areas of AI. It is particularly useful when dealing with problems that involve variables and a set of constraints that these variables must adhere to. In this method, you typically have a collection of variables, and each variable has a defined domain of possible values it can take. The primary objective is to find an assignment of values to these variables that simultaneously satisfies all the special constraints. Examples of problems include sudoku, map colouring, etc.

Backtracking search: It is a depth first search algorithm employed for solving problems like constraint satisfaction, combinatorial optimization and decision making tasks. It works by systematically trying out possible solⁿ and if it encounters a situation where a constraint cannot be satisfied or an invalid solⁿ is reached it backtracks to the

previous decision point and explores a different branch of search tree. This process continues a valid solⁿ is found or all possible options have been exhausted.

Input : Initial values for some letters in given problem.

Output : Unique values for letters S, E, N, D, M, O, R, Y

Algorithm : Constraint Satisfaction Method.

FAS's

1) What are the other constraint satisfaction problems?
→ other satisfaction problems include :-

1. N-Queen Problem

2. Sudoku

3. Map Colouring

2. What do you mean by constraint propagation?

→ Constraint Propagation is a fundamental techniques in constraint satisfaction problems. It involves using the constraints to deduce any and update possible values (domains) for variables. When you propagate constraints, you iteratively enforce consistency and eliminate values from variables domain that are inconsistent with constraints.

This process continues until no further deduction can be made, helping to reduce the search space and guide the search towards a solution.

3. Why backtracking search can be used to solve constraint satisfaction problem?

→ It is a effective approach for solving constraint satisfaction problem.

It systematically explores potential solⁿ by making choice for variable and checks if they lead to valid assignment of values to all variables. If a conflict is detected, it backtracks and tries alternative assignments.

This process continues until a valid solⁿ is found or it determines that no solⁿ exists.

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AIES Lab 3

```
def solutions():
    all_solutions = list()
    for s in range(9, -1, -1):
        for e in range(9, -1, -1):
            for n in range(9, -1, -1):
                for d in range(9, -1, -1):
                    for m in range(9, 0, -1):
                        for o in range(9, -1, -1):
                            for r in range(9, -1, -1):
                                for y in range(9, -1, -1):
                                    if len(set([s, e, n, d, m, o, r,
y])) == 8:
                                        send = 1000 * s + 100 * e + 10
                                        * n + d
                                        more = 1000 * m + 100 * o + 10
                                        * r + e
                                        money = 10000 * m + 1000 * o +
100 * n + 10 * e + y
                                        if send + more == money:
                                            all_solutions.append((send, more, money))
                                return all_solutions
print(solutions())
[(9567, 1085, 10652)]
```