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AIES Lab Assignment - 3

* Title - Implementation of solution of constraint satisfaction problem like SEND + MORE = MONEY or CROSS + ROADS = DANGER

* Aim - Solve constraint satisfaction problem like SEND + MORE = MONEY or CROSS + ROADS = DANGER.

* Theory

1) Constraint satisfaction problem

Constraint satisfaction depends on three components that play a crucial role in various areas of AI. It is particularly useful when dealing with problems that involve variables & a set of constraints that these variables must adhere to. In this method, you typically have a collection of variables, & each variable has a defined a 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 specified 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, combinational optimization, & decision-making tasks. It works by systematically trying out possible solutions &, if it encounters a situation where a constraint cannot be satisfied or an invalid solution is reached, it 'backtracks', to the previous decision point & explores a different branch of the search tree. This process continue a valid solution is found or all possible options have been exhausted.

* Input- Initial values ~~for us~~ some letters in given problem

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

* Algorithm - Constraint Satisfaction Method.

* FAQ's

Q1) What are the other constraint satisfaction problems?

Ans Other Satisfaction problems include-

- N-Queen Problem
- Sudoku
- Map Colouring

Q2) What do you mean by constraint propagation?

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

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

Q3) Why backtracking search can be used to solve constraint

Ans
- Backtracking search is an effective approach for solving constraint satisfaction problems
- It systematically explores potential solutions by making choices.
- If a conflict is detected, it backtracks & tries alternative assignments.
- This process continues until a valid solution is found or it determines that no solution exists.
- Backtracking effectively prunes the search space, reducing the possibilities explored.
- When combined with heuristics & variables ordering techniques it is applicable to a wide range of constraints satisfaction problems.

11/12/23

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)]
```