

## 18CSC305J- ARTIFICIAL INTELLEGEENCE

### Experiment-3

#### Implementation of Constraint Satisfaction Problem - Cryptarithmic puzzle

##### Team Ai 4 life

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##### Aim:

To implement the constraint satisfaction problem using cryptarithmic puzzle (SEND + MORE=MONEY).

##### Solution & Procedure:

SEND + MORE=MONEY is an interesting Cryptarithmic Problems wherein the digits are replaced by letters of the alphabets. The objective of this problem is to find a solution for

$$\begin{array}{rccccccccc} & & S & & E & & N & & D & & \\ + & & M & & O & & R & & E & & \\ \hline M & & O & & N & & E & & Y & & \end{array}$$

Therefore, we have to find a numerical value for {S, E, N, D, M, O, R, Y} that satisfies the given question. The simplest way to solve this problem will be to do permutation from 0-9 for all Letters and compute the above equation. However, this is definitely not optimizable as there will be a significantly high time duration. We should also consider that S and M not equal to 0, as they are the leading digits and leading digits cannot be 0.

### Calculation:

S = 9	E = 5	N = 6	D = 7
M = 1	O = 0	R = 8	Y = 2

SEND	9 5 6 7
+ MORE	1085
<u>MONEY</u>	<u>10652</u> //

∴ Hence Verified.

### Code:

```
from itertools import combinations, permutations

def replacements():
    for comb in combinations(range(10), 8):
        for perm in permutations(comb):
            if perm[0] * perm[1] != 0:
                yield dict(zip('SMENDORY', perm))

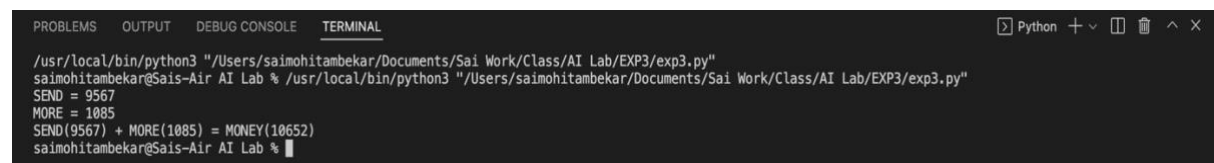
a, b, c = 'SEND', 'MORE', 'MONEY'
```

```

for replace in replacements():
    f = lambda x: sum(replace[e] * 10**i for i, e in enumerate(x[::-1]))
    if f(a) + f(b) == f(c):
        print("SEND = {}".format(f(a)))
        print("MORE = {}".format(f(b)))
        print("SEND({}) + MORE({}) = MONEY({})".format(f(a), f(b), f(c)))

```

## Output:



```

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
Python + - [ ] [ ] ^ X
/usr/local/bin/python3 "/Users/saimohitambekar/Documents/Sai Work/Class/AI Lab/EXP3/exp3.py"
saimohitambekar@Sais-Air AI Lab % /usr/local/bin/python3 "/Users/saimohitambekar/Documents/Sai Work/Class/AI Lab/EXP3/exp3.py"
SEND = 9567
MORE = 1085
SEND(9567) + MORE(1085) = MONEY(10652)
saimohitambekar@Sais-Air AI Lab %

```

## Result:

Implemented constraint satisfaction problem using the Cryptarithmic problem called SEND + MORE=MONEY.