Date: **Ex No:** 3.1	**Title of the Lab** Cryptarithmetic	**Name:** Yuvraj Singh Chauhan **Registration Number:** RA1911027010058 **Section:** N1 **Lab Batch:** 1 **Day Order:** 3

AIM:

To implement the Cryptarithmetic Problem (CROSS + ROADS = DANGER) problem in python.

Description of the Concept or Problem given:

Cryptarithmetic Problem is a type of constraint satisfaction problem where the game is about digits and its unique replacementeither with alphabets or other symbols. In cryptarithmetic problem, the digits (0-9) get substituted by some possible alphabets or symbols.

The task in cryptarithmetic problem is to substitute each digit withan alphabet to get the result arithmetically correct.

Manual Solution:

We can perform all the arithmetic operations on a givencryptarithmetic problem.

The rules or constraints on a cryptarithmetic problem are asfollows:

- There should be a unique digit to be replaced with a uniquealphabet.
- The result should satisfy the predefined arithmetic rules, i.e.,2+2 =4, nothing else.
- Digits should be from 0-9 only.
- There should be only one carry forward, while performing theaddition operation on a problem.
- The problem can be solved from both sides, i.e., lefthand side(L.H.S), or righthand side (R.H.S).

Program Implementation [Coding]

```
import itertools

def get_value(word, substitution):
```

```
    s = 0
    factor = 1
    for letter in reversed(word):
        s += factor * substitution[letter]
        factor *= 10
    return s

def solve2(equation):
    left, right = equation.lower().replace(' ', '').split('=')
    left = left.split('+')
    letters = set(right)
    for word in left:
        for letter in word:
            letters.add(letter)
    letters = list(letters)

    digits = range(10)
    for perm in itertools.permutations(digits, len(letters)):
        sol = dict(zip(letters, perm))

        if sum(get_value(word, sol) for word in left) == get_value(right, sol):
            print(' + '.join(str(get_value(word, sol)) for word in left) + " = {} (mapping:
{})".format(get_value(right, sol), sol))

a=input("Enter the Problem: ")
print(a)
solve2(a)
```

Screenshots of the Outputs:

```
Enter the Problem: CROSS + ROADS = DANGER
CROSS + ROADS = DANGER
96233 + 62513 = 158746 (mapping: {'r': 6, 's': 3, 'o': 2, 'e': 4, 'd': 1, 'c': 9, 'g': 7, 'a': 5, 'n': 8})
```

Signature of the Student

[YUVRAJ SINGH CHAUHAN]