

Date: Ex No: 3.1	Title of the Lab Cryptarithmic	Name: Mainak Chaudhuri Registration Number: RA1911027010039 Section: N1 Lab Batch: 1 Day Order: 3
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AIM:

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

Description of the Concept or Problem given:

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

The task in cryptarithmic problem is to substitute each digit with an alphabet to get the result arithmetically correct.

Manual Solution:

We can perform all the arithmetic operations on a given cryptarithmic problem.

The rules or constraints on a cryptarithmic problem are as follows:

- There should be a unique digit to be replaced with a unique alphabet.
- 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 the addition operation on a problem.
- The problem can be solved from both sides, i.e., left hand side (L.H.S), or right hand 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

[MAINAK CHAUDHURI]