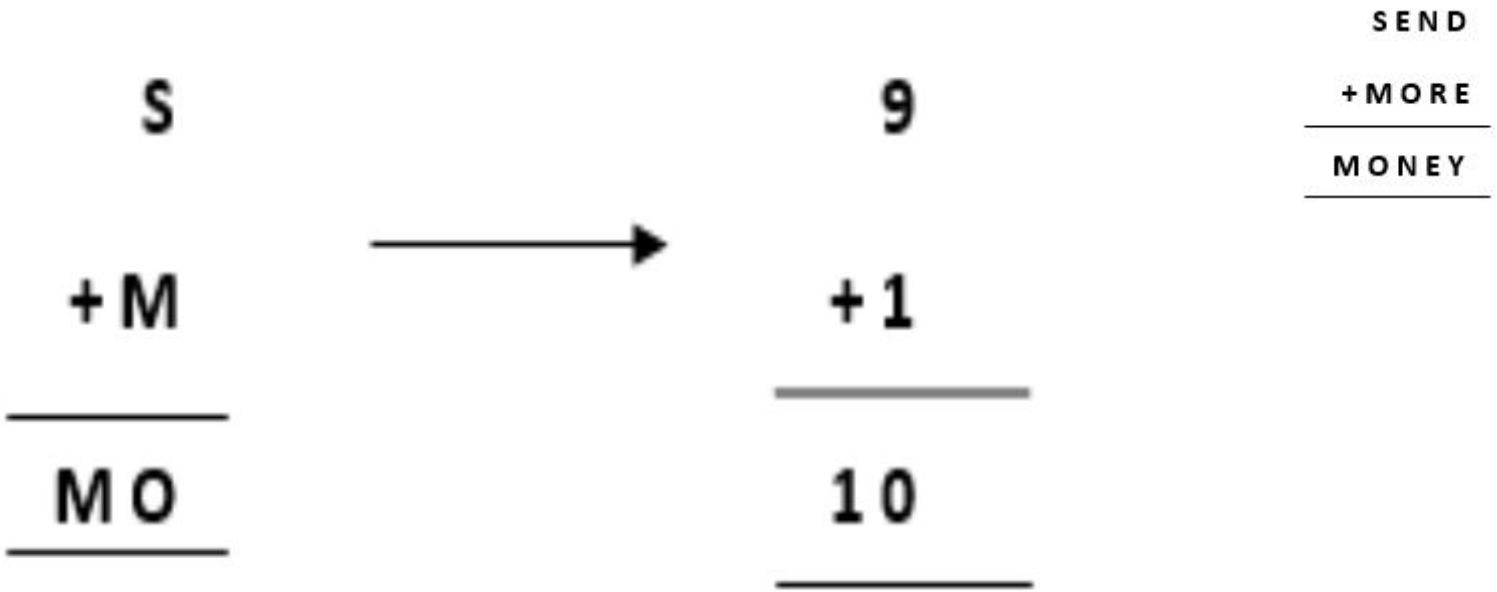
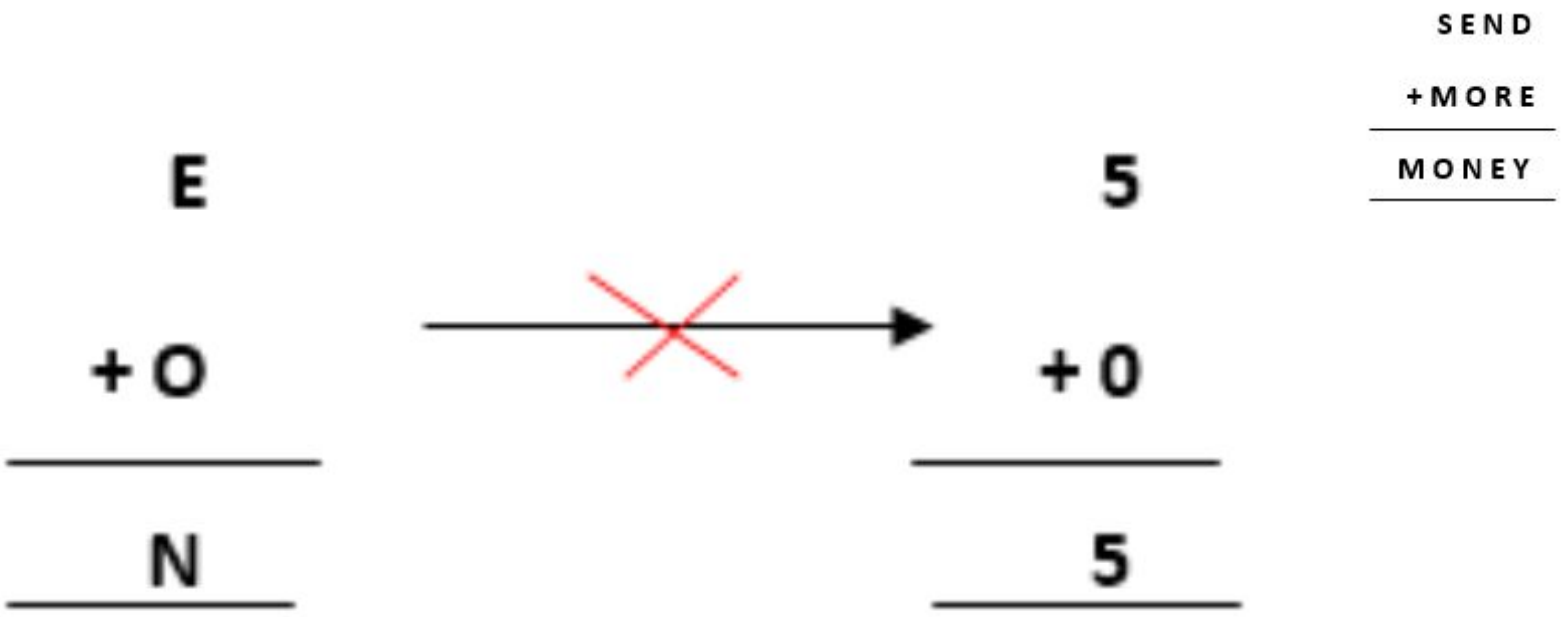
https://www.tutorialandexample.com/cryptarithmetic-problem

- Starting from the left hand side (L.H.S) , the terms are **S** and **M**. Assign a digit which could give a satisfactory result. L assign **S->9** and **M->1**.

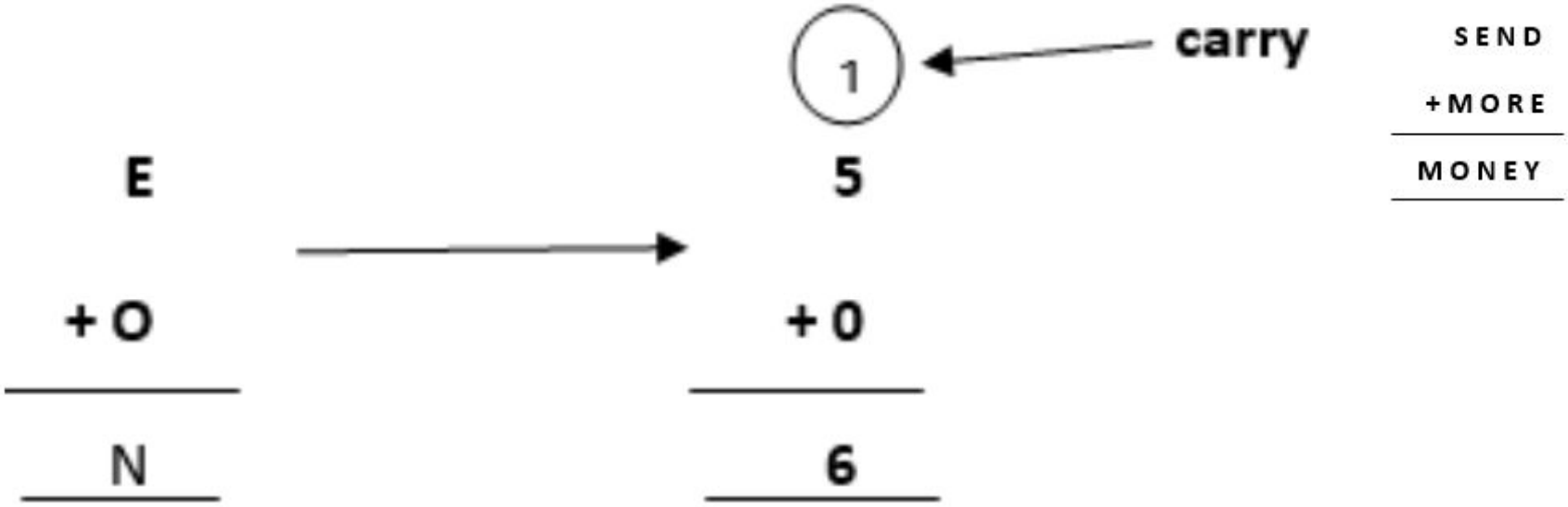


Hence, we get a satisfactory result by adding up the terms and got an assignment for **O** as **O->0** as well.

- Now, move ahead to the next terms **E** and **O** to get **N** as its output.

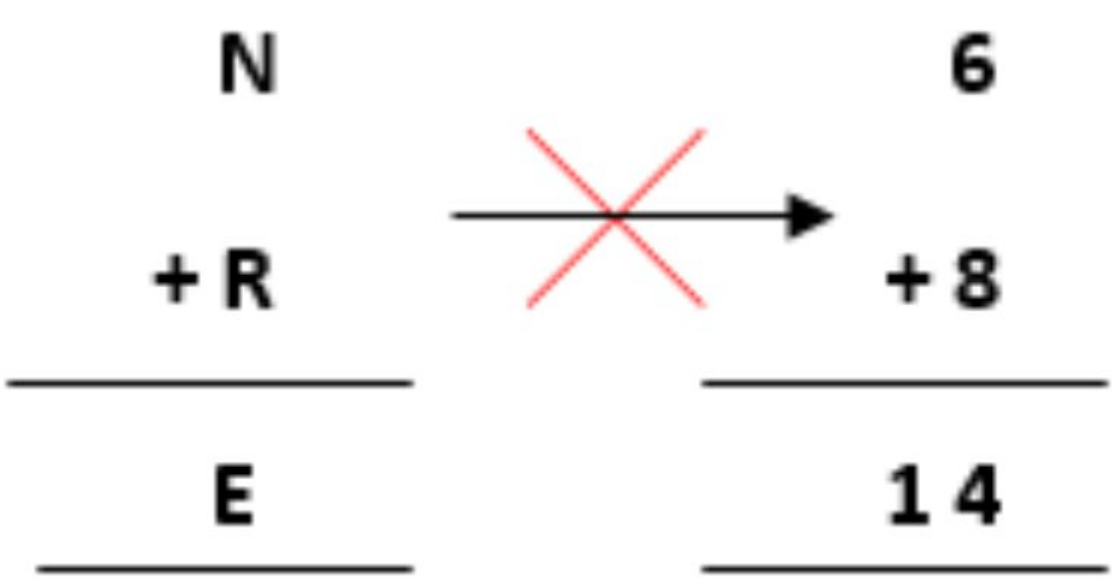


Adding E and O, which means 5+0=0, which is not possible because according to cryptarithmetic constraints, we cannot assign the same digit to two letters. So, we need to think more and assign some other value.



Note: When we will solve further, we will get one carry, so after applying it, the answer will be satisfied.

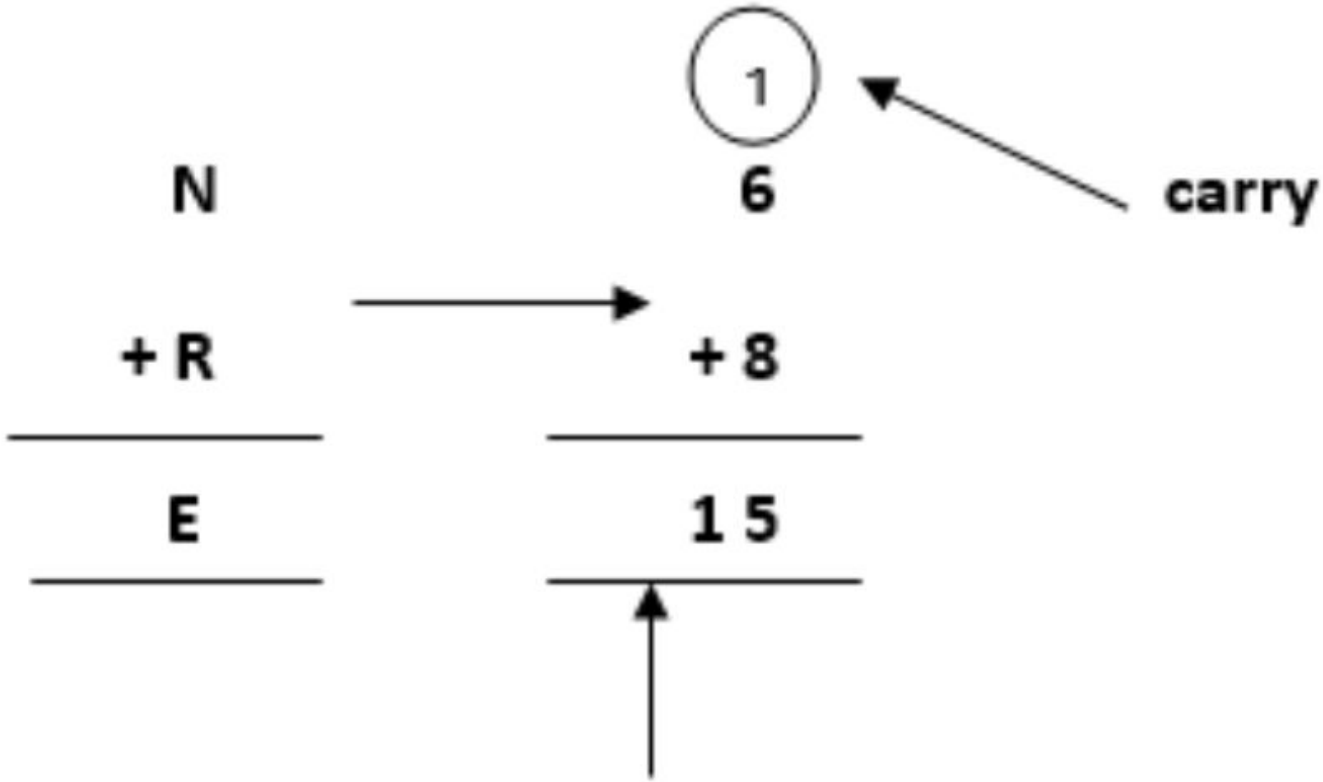
- Further, adding the next two terms **N** and **R** we get,



SEND
+MORE
MONEY

But, we have already assigned **E->5**. Thus, the above result does not satisfy the values because we are getting a different value for **E.** So, we need to think more.

Again, after solving the whole problem, we will get a carryover on this term, so our answer will be satisfied.



SEND

+MORE

MONEY

where 1 will be carry forward to the above term

Let's move ahead.

- Again, on adding the last two terms, i.e., the rightmost terms **D** and **E**, we get **Y** as its result.

```
  SEND
 +MORE
------
 MONEY
------
```

```
  D
 +E
---
  Y
---
```

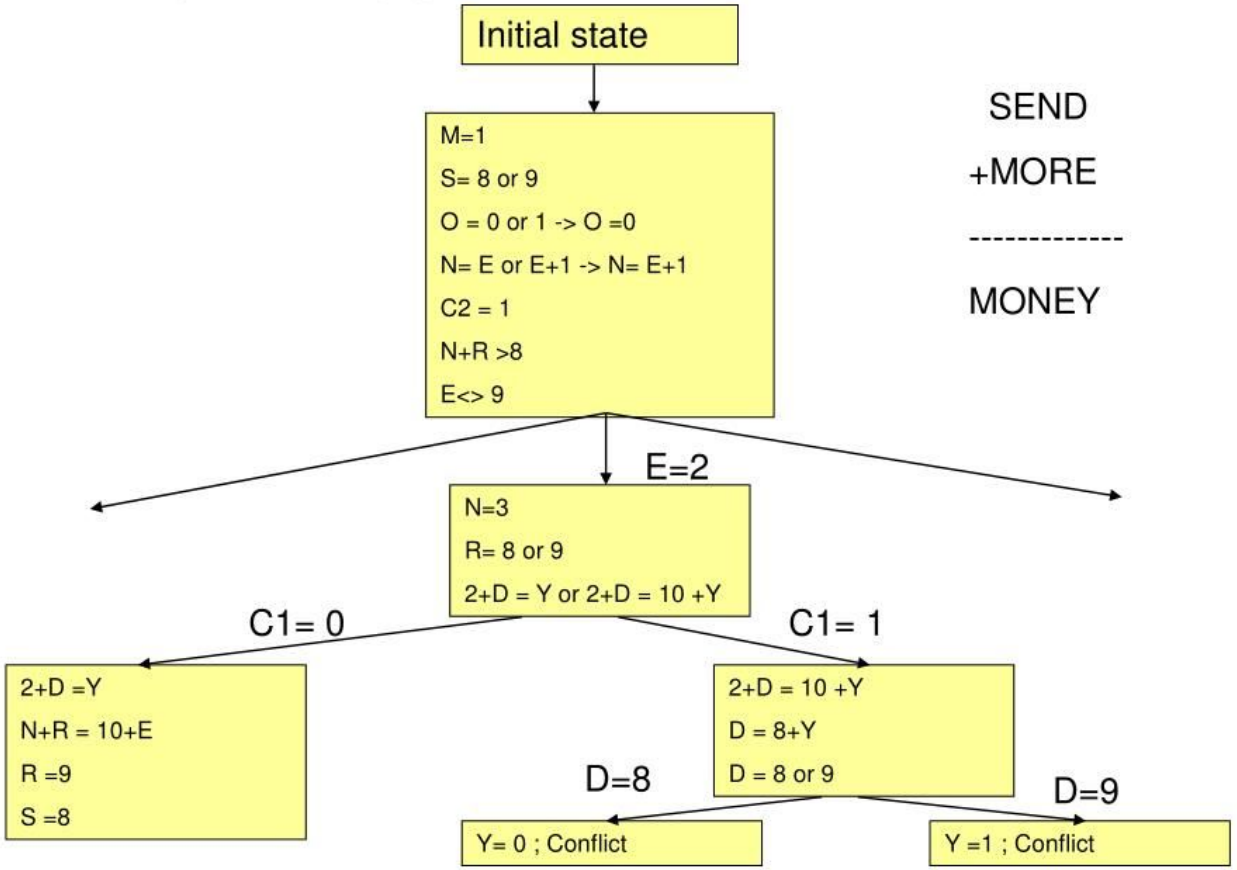
```
  7
 +5
---
 12
---
```

where 1 will be carry forward to the above term

S	9
E	5
N	6
D	7

D	7
M	1
O	0
R	8
y	2

Solving a Cryptarithmetic Problem



https://www.brainkart.com/article/Various-Types-of-Artificial-Intelligence-Problems-and-their-Solutions_8873/

Explanation:
Before determining whether water jug could be solved using constraint satisfaction method, firstly let us understand what are the condition for problem to be solved using constraint satisfaction method.

For problem to be solved using constraint satisfaction method, it should have:

1. Set of variable
2. Domain of values
3. Set of constraint

Now we need to identify all three in given water jug problem:

1. **Set of variable:** If X and Y corresponds to state where X is amount of water in Jug 1 and Y is amount of water in Jug 2 then X and Y are variable we are searching for.
2. **Domain of Value:** Domain of Value/Variable implies variable could not infinite number of value like in this case value of X and Y could be less than the m and n (Amount of water in jug at any state will always be less than or equal to capacity of water).
3. **Set of Constraint:** Direct constraint are given in problem that we could perform limited operation. (Read the problem).

Since our problem statement have all the required parameter for problem to be solved using Constrain Satisfaction method.

Therefore, **YES the problem could be solved using Constraint Satisfaction Method.**

Most of the Problem belong to this class are mostly solved using Search, Backtracking or Linear Programming.

Water Jug problem could be solved using Breadth First Search and also by Backtracking.