A Recipe for Problem Solving

Algorithm : is a set of steps fo accomplish a certain task

$$(x+a)^n = \sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k}$$

A Recipe for Problem Solving

UNDERSTAND THE PROBLEM

EXPLORE EXAMPLES

BREAK IT DOWN

SOLVE / SIMPLIFY

LOOK BACK REFACTOR

Step 1 - UNDERSTAND THE PROBLEM

1. Can we restate the problem in our own words?
2. What are the inputs that go into the problem?
3. What are the outputs that come from the problem?
4. Can the outputs be determined from the inputs? In other words do we have enough information to solve this problem?
5. What should I label the important piece of data that are the part of a problem?

Step 1 - UNDERSTAND THE PROBLEM

Write a function that takes two numbers and returns their sum

1. Can we restate the problem in our own words?

Implement addition

2. What are the inputs that go into the problem?

Integer? Float? Or?

3. What are the outputs that come from the problem?

Integer? Float? Or?

4. Can the outputs be determined from the inputs? In other words do we have enough information to solve this problem?

Yes

5. What should I label the important piece of data that are the part of a problem?

Add, Sum

Step 2 - EXPLORE EXAMPLES

1. Start with simple examples
2. Progress to more complex examples
3. Explore examples with empty
4. Explore the examples with invalid inputs

```
// Write a function with takes in a string and returns count of each character in the string

// Step 1 - Simple examples

charCount("aa") // {a :2}
charCount("hello") // {h:1, e:1, l:2, o:1 }

//  Step 2 - Complex examples
"My name is Elshad"

// Step 3 - Empty Inputs
charCount("");

// Step 4 - Invalid input

charCount(1)
```

Step 3 - BREAK IT DOWN

Write out the steps that you need to take

```
1  // Write a function with takes in a string and returns count of each character in the string
2
3  //  charCount("My name is Elshad")
4  //      {m:2,
5  //       y:1,
6  //       n:1,
7  //       a:2,
8  //       e:2,
9  //       i:1,
10 //       s:2,
11 //       l:1,
12 //       h:1,
13 //       d:1}
14
15 public String charCount(String str) {
16   // declare object to return at the end
17   // loop over the string
18         // if it is a letter
19           // lowercase the character
20           // if the character is in our object add one to the value it
21           // if the character is not in our object, add it to the object with the value of 1
22   // Covert the object to string
23   // return object
24 }
25
```

SOLVE / SIMPLIFY

Simplify the Problem

- Find the core difficulty
- Temporarily ignore that difficulty
- Write a simplified solution
- Then incorporate that difficulty

```java
public String charCount(String str) {
// declare object to return at the end
  String result;
  HashMap<Character, Integer> hashMap = new HashMap<Character, Integer>();
// loop over the string
  for (int i = 0; i<str.length(); i++) {
    // if it is a letter
          // lowercase the character
          Character chr = str.charAt(i);
          // if the character is in our object add one to the value it
          if (hashMap.containsKey(chr)) {
            hashMap.put(chr, hashMap.get(chr)+1);
          } else {
            // if the character is not in our object, add it to the object with the value of 1
            hashMap.put(chr, 1);
          }
  }

// Covert the object to string
result = hashMap.toString();
// return object
return result;
}
```

LOOK BACK REFACTOR

- Can we check the result?
- Can we drive the result differently?
- Can we understand it at a glance?
- Can we use the result or method for some other problem?
- Can you improve the performance of your solution?
- How other people solve this problem?

Summarize

UNDERSTAND THE PROBLEM

EXPLORE EXAMPLES

BREAK IT DOWN

SOLVE / SIMPLIFY

LOOK BACK REFACTOR