ACSL

**American Computer Science League  
Check Sum**

#### All-Start #2

**2012 - 2013**

**PROBLEM:** The Luhn Algorithm is a check sum formula used to validate identification numbers such as those used on credit cards. It can also be used to find several simple kinds of transcription errors. The last digit of most identification numbers is the check sum digit.  
To determine if a number is valid using the check sum method use the following algorithm:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | 7 | 9 | 9 | 2 | 7 | 3 | 9 | 8 | 7 | 1 | 3 |
| Doubles | 7 | 18 | 9 | 4 | 7 | 6 | 9 | 16 | 7 | 2 | x |
| Sum of Digits | 7 | 9 | 9 | 4 | 7 | 6 | 9 | 7 | 7 | 2 | 67 |

1. Counting from the check sum digit, double the value of every second digit.  
 2. If any of those doublings cause the value to be greater than 9, then change the value to the sum of its digits.  
 3. Sum all the values except for the check sum.  
 4. Multiply the sum by 9.  
 5. Calculate the product MOD 10.   
 6. If the calculated value is equivalent to the check sum, the number is valid.

Example #1:

67 x 9 = 603. 603 MOD 10 = 3. Since this matches the check sum digit, the number is valid.

The most common error is the single digit error - when a digit is written as an adjacent digit. That is a 4 is written as a 3 or a 5. Note that a 0 would become a 9 when 1 is subtracted and 9 would become a 0 when 1 is added.

**INPUT**: There will be 5 lines of input. Each line will contain one identification number. The maximum length of an identification number is 15.

Example #2: 78927398713 is not valid. The algorithm produces a 5. The correct check sum is 3 and the number contains a single digit error. Starting with the left most digit, try adjacent digits (±1). Neither 6 nor 8 give a check sum of 3. Moving to the right, again try adjacent digits. 7 gives a check sum of 7. A 9 gives a check sum of 3 and is the correct digit. Print the correct number by replacing the 8 with a 9.

**OUTPUT**: For each input line, verify the check sum digit. If it is correct, print VALID. If it is not correct, the check sum digit will be correct but the number will contain a single digit error. Starting on the left, find the first number that gives the correct check sum. Print the number that produces the correct check sum.

SAMPLE INPUT SAMPLE OUTPUT

1. 78927398715 1. VALID  
2. 112358 2. 122358  
3. 88888888 3. VALID  
4. 9900901 4. 9901901  
5. 32075270 5. 32074270

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TEST DATA**

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**TEST INPUT TEST OUTPUT**1. 436549127 1. 426549127  
2. 122539 2. 222539  
3. 1119991998 3. VALID  
4. 876543219 4. 876443219  
5, 9100827300650 5. 9100827300640