

Problem Set 2 Exercise #18: Identifying Undergrad Cards

Reference: Lecture 5 notes

Learning objective: Repetition statements

Estimated completion time: 45 minutes

Problem statement:

[CS1010 AY2012/13 Semester 1 Practical Exam 1 Exercise 2]

The Undergrad Inc. has issued its own Undergrad Cards, called uCard, for its distinguished undergraduate clients. Each of these uCards has a unique card number, which is a positive integer.

A. Generating a Check number for a uCard Number

To check the validity of an uCard number, the company invents a Luhn-ah algorithm¹ described here to generate a check number.

Starting with an uCard number (of type **int**), for example 323456789.

We examine each digit in the number. Starting with the second digit (from the right), we double every other digit. The others are left intact.

For example, given the 9 digits: 3 2 3 4 5 6 7 8 9

Our doubling effort produces: 3 **4** 3 **8** 5 **12** 7 **16** 9

Lastly, we treat the above result as a new list of **single** digits:

3 4 3 8 5 1 2 7 1 6 9

We then sum up all these digits to obtain the check number:

$$3 + 4 + 3 + 8 + 5 + 1 + 2 + 7 + 1 + 6 + 9 = \mathbf{49}$$

If the check number is a **multiple of 7** (e.g.: 7, 14, 21, 28, ...), then the uCard number is valid; otherwise, it is invalid. In our example above, the uCard number is valid.

¹ This is a modification of the Luhn Algorithm which has been used for credit card number validation.

B. Identifying the Issuing Branch

A valid uCard can be issued from several branches of Undergrad Inc. The table below characterizes recognizable uCard numbers issued by the respective branches.

Issuing Branches	First two digits of the Card must be
East branch	31 – 35
West branch	51 – 55
Central branch	All other cases

For example, the uCard number 323456789, which begins with 32, was issued by the East branch. The uCard number 54123656, which has the check number (as computed by the Luhn-ah algorithm) of 28 and its first two digits being 54, was issued by West branch. Lastly, the uCard number 23, which has the check number of 7 and its first two digits not from 31-35 and 51-55, was issued by Central branch.

Your Task

In this exercise, you are to write a program **uCard.c** to read in a positive number (of type **int**), and perform the following tasks:

- Generate the check number using the Luhn-ah algorithm described above.
- Based on the check number produced at the last step of the algorithm, print one of the following two messages:
 - If the check number is a multiple of 7, the message is “Valid”
 - If the check number is not a multiple of 7, the message is “Invalid”
- If the number is valid, continue to determine the branch that issued the card, and print the message “Issued by X branch”, where X can either be “East”, “West” or “Central”. If the number is invalid, there is no need to do anything at this stage.

You may assume that the input is a positive integer smaller than the maximum integer defined for **int** type.

Your program MUST HAVE a function called **luhnah()** that performs the Luhn-ah algorithm and returns the check number and another function called **print_branch()** that prints the issuing branch. You may choose to define additional functions to help in the computation.

Sample run #1:

```
Enter uCard Number: 323456789  
The check number is 49  
Valid  
Issued by East branch
```

Sample run #2:

```
Enter uCard Number: 55010011  
The check number is 10  
Invalid
```

Sample run #3:

```
Enter uCard Number: 54123656  
The check number is 28  
Valid  
Issued by West branch
```

Sample run #4:

```
Enter uCard Number: 45223  
The check number is 14  
Valid  
Issued by Central branch
```