Classes: A First Look

```
#include <iostream.h>

#define SIZE 10

// Declare a stack class for characters
class stack {
    char stck[SIZE]; // holds the stack
    int tos;              // index of top-of-stack

public:
    void init();              // initialize stack
    void push(char ch); // push character on stack
    char pop();               // pop character from stack
}
```

```
// Initialize the stack
void stack::init() { tos = 0; }

// Push a character.
void stack::push(char ch) {
    if (tos==SIZE) { cout << “Stack if full”; return; }
    stck[tos] = ch;
    tos++; }

// Pop a character
char stack::pop() {
    if (tos==0) { cout << “Stack is empty”;
                  return 0; // return null on empty stack
                }
    tos--; return stck[tos]; }
```

```
main() {
    stack s1, s2; // create two stacks
    int i;
    // initialize the stacks
    s1.init();
    s2.init();

    s1.push(‘a);          s2.push(‘x’);
    s1.push(‘b’);         s2.push(‘y’);
    s1.push(‘c’);         s2.push(‘z’);

    for (i=0; i<3; i++) cout << “Pop s1: “ << s1.pop() << “\n”;
    for (i=0; i<3; i++) cout << “Pop s2: “ << s2.pop() << “\n”;

    return 0;
}
```

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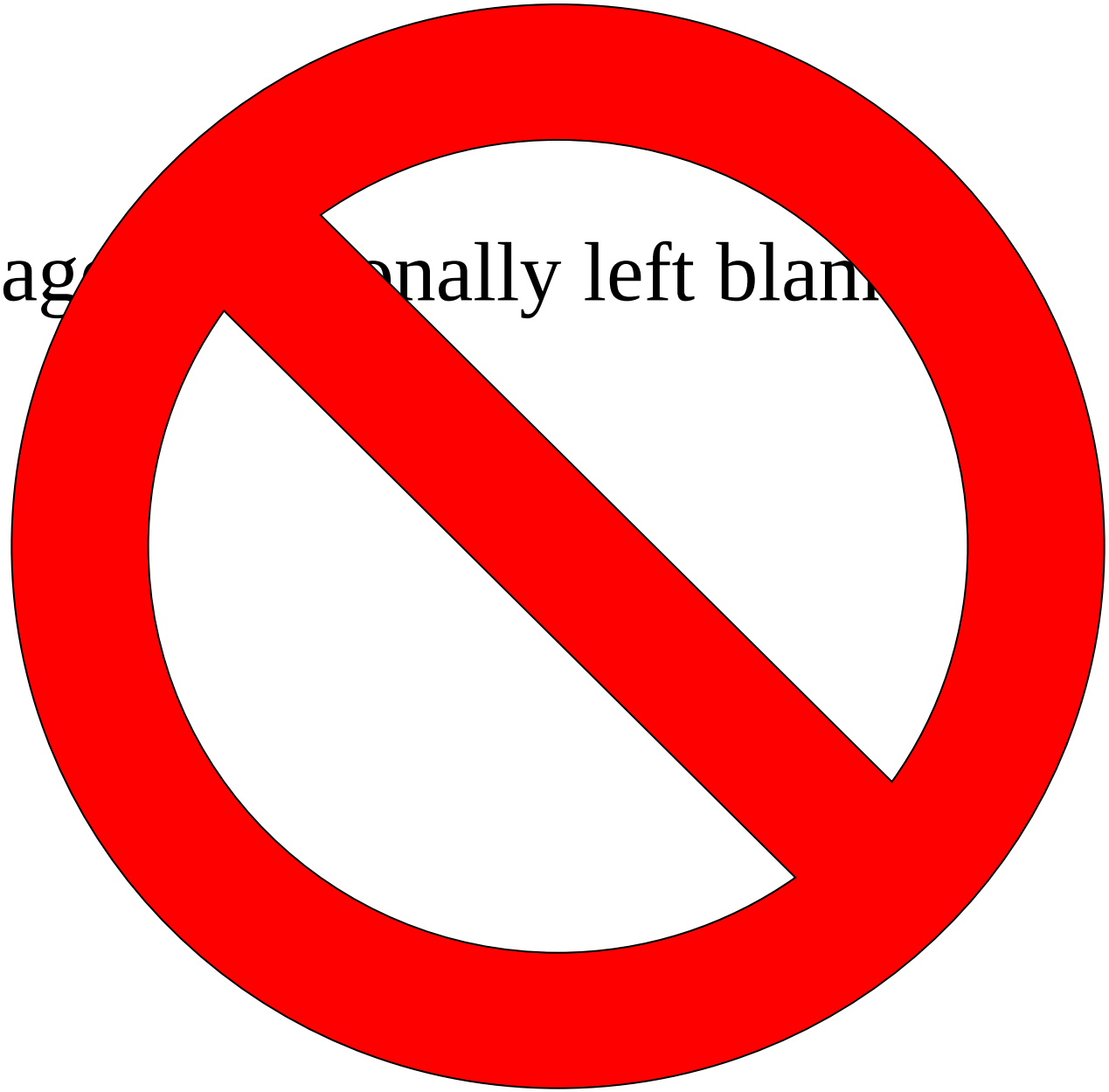


HW #2 (Credit card number validation)

- Design a modular C++ (or Java or Python if you prefer) program to solve the following problem.

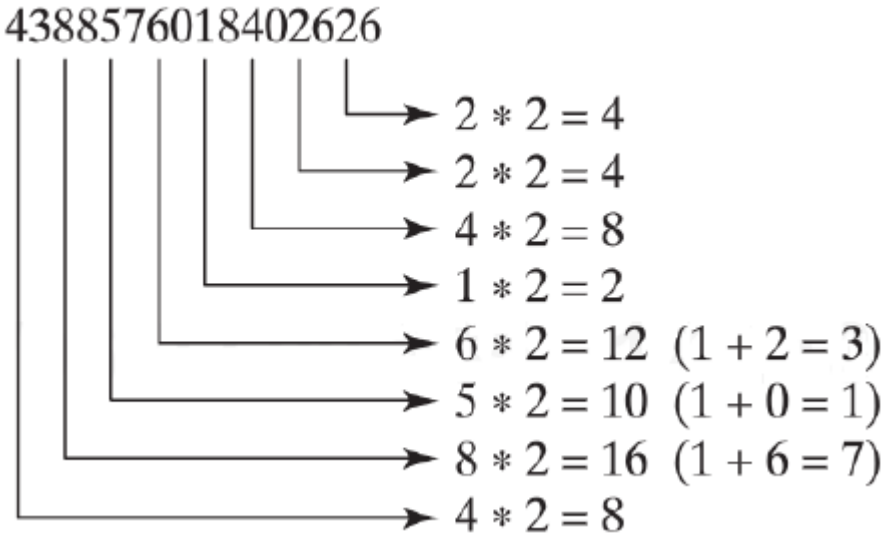
- Credit card numbers follow certain patterns. A credit card number must have between 13 and 16 digits. The number must start with the following:
- 4 for Visa cards
- 5 for MasterCard cards
- 37 for American Express cards
- 6 for Discover cards

HW #2 (2)

- In 1954, Hans Luhn of IBM proposed an algorithm for validating credit card numbers. The algorithm is useful to determine whether a card number is entered correctly or is scanned correctly by a scanner. Almost all credit card numbers are generated following this validity check, commonly known as the *Luhn check* or the *Mod 10 check*. It can be described as follows. (For illustration, consider the card number 438857601840262 6.)

1. Double every second digit from right to left. If doubling of a digit results in a two-digit number, add the two digits to get a single digit number.

HW #2 (3)



2. Now add all single-digit numbers from Step 1.

   4 + 4 + 8 + 2 + 3 + 1 + 7 + 8 = 37

3. Add all digits in the odd places from right to left in the card number.

   6 + 6 + 0 + 8 + 0 + 7 + 8 + 3 = 38

HW #2 (4)

4. Sum the results from Step 2 and Step 3.

   37 + 38 = 75

5. If the result from Step 4 is divisible by 10, the card number is valid; otherwise, it is invalid. For example, the number 4388576018402626 is invalid, but the number 4388576018410707 is valid. Likewise, 422661008116957 1 and 5490123456789128 are valid numbers as well.

- Write a program that reads a file containing a list of **newline**-delimited strings, each representing a credit card number. Display whether the number is valid.

HW #2 (5)

- Also, the file may or may not have a **newline** character before **EOF**.
- Moreover, we define in advance four particular strings, “004”, “005”, “0037”, and “006”, for other purpose, which is explained in page 7.

Design your program to use the following functions:

// Return true if the card number is valid

bool isvalid (const string& cardNumber)

HW #2 (6)

// Get the result from Step 2

int sumofDoubleEvenPlace (const string& cardNumber)

// Return this number if it is a single digit, otherwise,

// return the sum of the two digits

int getDigit (int number)

// Return sum of odd-place digits in the card number

int sumOfOddPlace (const string& cardNumber)

HW #2 (7)

// Return true if substr is the prefix for cardNumber

bool startsWith (const string& cardNumber,

const string& substr)

// Return a **valid** credit card number for the given brand:

// “004” for Visa cards

// “005” for MasterCard cards

// “0037” for American Express cards

// “006” for Discover cards

string& fakeOne (const string& brand)

HW #2 (8)

// One easier way for doing this is you keep generating new
// number combination using a **random number generator**
// until a valid card number of given brand is found. There
// may be other better ways….

// You should time your code, for example, calling
// *gettimeofday()*, and report timing information in
// microseconds.

HW #2 (9)

Here are the main criteria for this problem

- Read the name of the data file from the command line in argv[1].
- Open the file, read the data and save individual credit card number in an array.
- Compute and check whether that credit card number is valid.
- Display the final answer with an annotation.

HW #2 (10)

Program requirements

- Use good program style. This includes (but is not limited to) the following.

1. Short main function with top-level function calls.
2. Separate interface and implementation files for your globals.
3. Indentation and whitespace.
4. Descriptive names for your functions/constants/variables.
5. Symbolic constants where appropriate.

HW #2 (11)

- A namespace around your globals.
- A namespace alias in main to preface your functions invocations.
- Error checking should trap any potential error, such as too few command line args, then print an appropriate message and quit.

HW #2 (12)

- **Sample Input**

438857601840262 6

5490123456789128

004

004

- **Sample Output**

438857601840262 6: an invalid Visa card #

5490123456789128: a valid MasterCard card #

Generated a valid Visa card #: 438857601841070 7; Timing: 123 microseconds

Generated a valid Visa card #: 422661008116957 1; Timing: 168 microseconds

Fake credit card numbers for all major brands

- **Visa**:
  4556443985096249
  4532490130177027
  4872229942657026
  4485664397248591
  4532716601603095
  4929373876667651

- **MasterCard**:
  5483429059012878
  5124710941822367
  5591330937779507
  5537538941421471
  5285606799287098
  5203316333196172

- **American Express (AMEX)**:
  373025858858430
  373868046043179
  374893294266032
  375577400395277
  372988244909889

- **Discover**:
  6011818740391627
  6011783412179876
  6011811675541373
  6011800857885708
  6011904390073358
  6011980675192147