Project 2

CSCI 140
C++ Language and Object Development

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Development Environment
MSVS 2012/2015

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PROJECT NOTE

Project 2 is to create a program that does simple math algebra (addition and subtraction) using paper-and-pen algorithm. For this project, I ran until countless syntax and logic errors. Even though after my program had successful passed the provided test case, I continued to discover more errors in my program as I attempted to do the extra credit. I did the extra credit B option (allow multiplication). Below is a list of problems I encountered:

➢ Keeping tracks of the borrow and carry for the addition and subtraction

➢ Unable to validate integer overflow and bad digit input.

➢ Only print part of the result integer

➢ Print full array length including all the zero

➢ Output weird answer because the arrays still store values from the previous calculation

➢ Can only do multiple by 1 digit because could only save one set of multiplication

Like I had mention earlier, I encountered a lot of errors throughout this project. Even while doing the extra credit, I had to go back and forth to fix my original project and the extra credit. However, I did get everything to work properly. My project is completed and success passed many test cases.

PSEUDOCODE

Constant int SIZE = 20;

Declare int array1[SIZE], array2[SIZE], array3[SIZE];
Declare string num1, num2, operand;
Declare temp = 0;

Display "Program Information"

Display "Enter an expression →"
Input num1, operand, num2;

While (NOT 0%0)
| While (num1.length > SIZE OR num2.length > SIZE)
| | Display "too large"
|
| While (NOT +, -, or *)
| | Display "invalid operator"

```
|
|    for (int I = 0 to num1.length)
|    |    num1[i] = array1[i];
|
|    for (int I = 0 to num2.length)
|    |    num2[i] = array2[i];
|
|    If (operand == +)
|    |    for (int I = 0 to num1.length)
|    |    |    Array3[i] = temp + array1[i] + array2[i];
|    |    |    If (array3[i] >= 10)
|    |    |    |    Array3[1] %=10;
|    |    |    |    Temp = 1;
|    |    |    Else
|    |    |    |    Temp = 0;
|
|    Else if (operand == -)
|    |    for (int I = 0 to num1.length)
|    |    |    Array3[i] = array1[i] - temp - array2[i];
|    |    |    If (array3[i] < 0)
|    |    |    |    Array3[1] += 10;
|    |    |    |    Temp = 1;
|    |    |    Else
|    |    |    |    Temp = 0;
|
|    Display num1 +  operand + num2 + =;
|    for (int I = 0 to num1.length)
|    |    display array3[i];
|
|    Display "Enter an expression →"
|    Input num1, operand, num2;

Display "Thanks for using my program. Good Bye!"
```

INPUT/OUTPUT

```
C:\Windows\system32\cmd.exe                                        _  □  ✕

Simple Math Calculation by Mai Pham
This program would do simple math calculation:
addition, subtraction, and multiplication.

Enter an expression --> 1234 + 72
1234 + 72 = 1306

Enter an expression --> 1234 - 72
1234 - 72 = 1162

Enter an expression --> 123456789012345678901234 - 1
Invalid operand (too large).

Enter an expression --> 123456789 - 123A5
Invalid operand (bad digit).

Enter an expression --> 7777777777777777777 + 2222222222222222222
7777777777777777777 + 2222222222222222222 = 9999999999999999999

Enter an expression --> 9999999999999999999 + 1
Integer Overflow.

Enter an expression --> 0 % 0
Thanks for using my program. Good bye!
Press any key to continue . . .
```
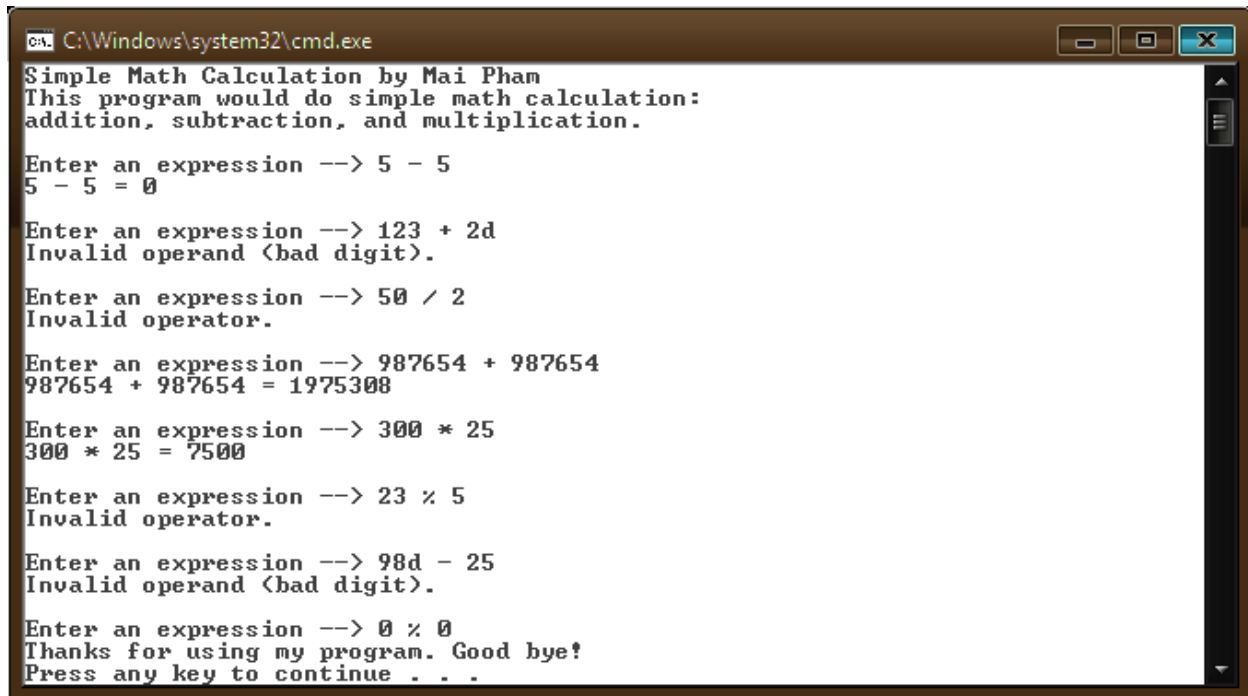
```
C:\Windows\system32\cmd.exe                                        _  □  ✕

Simple Math Calculation by Mai Pham
This program would do simple math calculation:
addition, subtraction, and multiplication.

Enter an expression --> 963852741963852741 * 95
963852741963852741 * 95 = 91566010486566010395

Enter an expression --> 9638527419638527411 * 98
Integer Overflow.

Enter an expression --> 12345 * 12345
12345 * 12345 = 152399025

Enter an expression --> 0 % 0
Thanks for using my program. Good bye!
Press any key to continue . . .
```

SOURCE CODE

```
/*      Program:            MSVS 2012/2015
        Author:             Mai Pham
        Class:              CSCI 140
        Date:               04/13/2017
        Description:        Project 2 - Big Integers + A EC
        I certify that the code below is my own work.
        Exception(s): N/A
*/

#include <iostream>
#include <string>
using namespace std;

int validate(string num1, string oper, string num2);
int check(string number);
void string2array(string num, int number[]);
void add(int number1[], int number2[], int number3[], int &over);
void subtract(int number1[], int number2[], int number3[]);
void multiply(int number1[], int number2[], int number3[], int &over);
void output(string num1, string oper, string num2, int number[]);

const int SIZE = 20;

int main()
{
        int number1[SIZE] = { 0 }, number2[SIZE] = { 0 }, number3[SIZE] = { 0 };
        string num1, oper, num2;
```

```cpp
        int over = 0;

        cout << "Simple Math Calculation by Mai Pham\n";
        cout << "This program would do simple math calculation:\n";
        cout << "addition, subtraction, and multiplication.\n\n";

        cout << "Enter an expression --> ";
        cin >> num1 >> oper >> num2;

        while (!(num1 == "0" && oper == "%" && num2 == "0"))
        {
                if (validate(num1, oper, num2) == 0)
                {
                        string2array(num1, number1);
                        string2array(num2, number2);

                        if (oper == "+")
                                add(number1, number2, number3, over);
                        else if (oper == "-")
                                subtract(number1, number2, number3);
                        else if (oper == "*")
                                multiply(number1, number2, number3, over);

                        if (over == 0)
                                output(num1, oper, num2, number3);
                        else
                                cout << "Integer Overflow." << endl;

                        memset(number1, 0, sizeof(number1));
                        memset(number2, 0, sizeof(number2));
                        memset(number3, 0, sizeof(number3));
                }
                cout << "\nEnter an expression --> ";
                cin >> num1 >> oper >> num2;
        }
        cout << "Thanks for using my program. Good bye!" << endl;
        return 0;
}
int validate(string num1, string oper, string num2)
{
        if (num1.length() > SIZE || num2.length() > SIZE)
        {
                cout << "Invalid operand (too large)." << endl;
                return 1;
        }
        if (oper != "+" && oper != "-" && oper != "*")
        {
                cout << "Invalid operator." << endl;
                return 1;
        }
        if (check(num1) == 1 || check(num2) == 1)
        {
                cout << "Invalid operand (bad digit)." << endl;
                return 1;
        }
        return 0;
```

```
}
int check(string number)
{
        for (int i = 0; i < number.length(); i++)
        {
                if (number[i] < '0' || number[i] > '9')
                        return 1;
        }
        return 0;
}
void string2array(string num, int number[])
{
        int j = SIZE - 1;
        int i = num.length() - 1;
        while (i >= 0)
        {
                number[j] = num[i] - '0';
                j--;
                i--;
        }
}
void add(int number1[], int number2[], int number3[], int &over)
{
        int temp = 0;
        over = 0;
        for (int i = SIZE - 1; i >= 0; i--)
        {
                number3[i] = temp + number1[i] + number2[i];
                if (number3[i] >= 10)
                {
                        number3[i] %= 10;
                        temp = 1;
                }
                else
                        temp = 0;
        }
        if (temp == 0)
                over = 0;
        else
                over = 1;
}
void subtract(int number1[], int number2[], int number3[])
{
        int temp = 0;
        for (int i = SIZE - 1; i >= 0; i--)
        {
                number3[i] = number1[i] - temp - number2[i];
                if (number3[i] < 0)
                {
                        number3[i] = ((number1[i] - temp) + 10) - number2[i];
                        temp = 1;
                }
                else
                        temp = 0;
        }
}
```

```cpp
void multiply(int number1[], int number2[], int number3[], int &over)
{
        int i, j, k, product;
        int carry1 = 0, carry2 = 0;
        over = 0;
        k = 0;
        for (i = SIZE - 1; i >= 0; i--)
        {
                for (j = SIZE - 1; j >= 0; j--)
                {
                        product = number1[j] * number2[i];
                        product += carry1;
                        if (product >= 10)
                        {
                                carry1 = product / 10;
                                product %= 10;
                        }
                        else
                                carry1 = 0;

                        number3[j - k] += product + carry2;

                        if (number3[j - k] >= 10)
                        {
                                carry2 = number3[j - k] / 10;
                                number3[j - k] %= 10;
                        }
                        else
                                carry2 = 0;

                        if ((j - k) <= 0)
                        {
                                if (carry1 != 0 || carry2 != 0)
                                        over = 1;
                                break;
                        }
                }
                k++;
        }
}
void output(string num1, string oper, string num2, int number[])
{
        int length = SIZE - 1;
        cout << num1 << " " << oper << " " << num2 << " = ";
        for (int i = 0; i < SIZE; i++)
        {
                if (number[i] != 0)
                {
                        length = i;
                        break;
                }
        }
        for (int i = length; i < SIZE; i++)
                cout << number[i];
        cout << endl;
}
```