# CSCI 140 PA 5 Submission

Due Date:4/2/2025 Late (date and time):________________

Name(s):Ean Zheng

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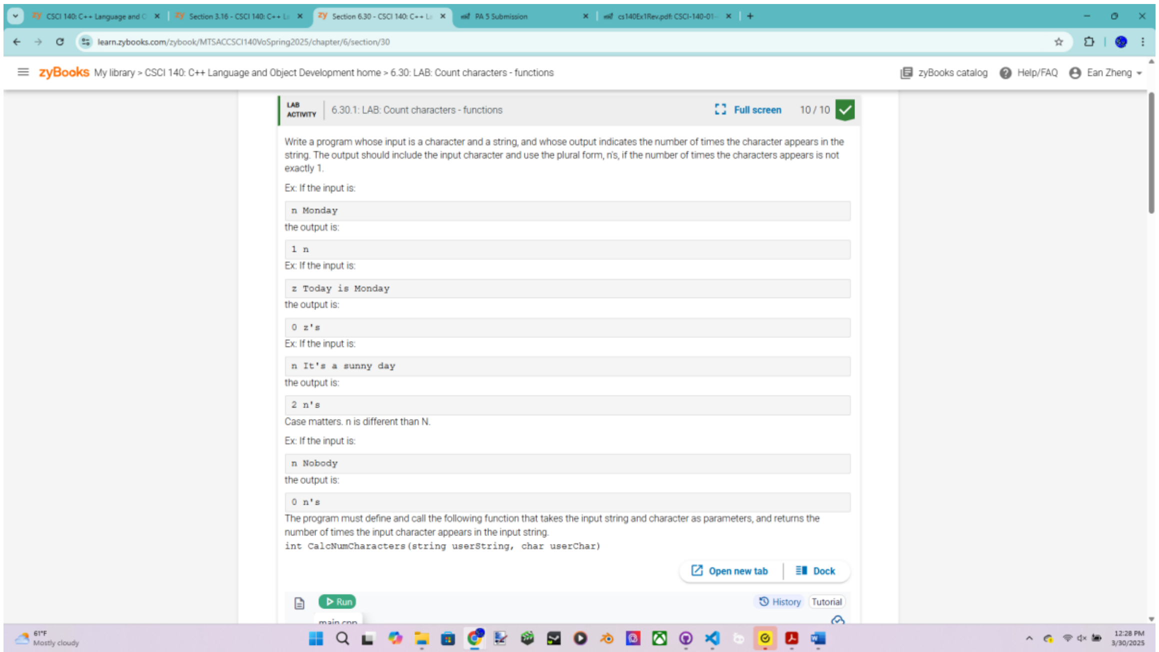
Exercise 1 – 6.30 LAB: Count characters – functions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Tutorial
main.cpp
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12:28 PM
3/30/2025

Write a program whose input is a character and a string, and whose output indicates the number of times the character appears in the string. The output should include the input character and use the plural form, n's, if the number of times the characters appears is not exactly 1.

Ex: If the input is:

```
n Monday
```

the output is:

```
1 n
```

Ex: If the input is:

```
z Today is Monday
```

the output is:

```
0 z's
```

Ex: If the input is:

```
n It's a sunny day
```

the output is:

```
2 n's
```

Case matters. n is different than N.

Ex: If the input is:

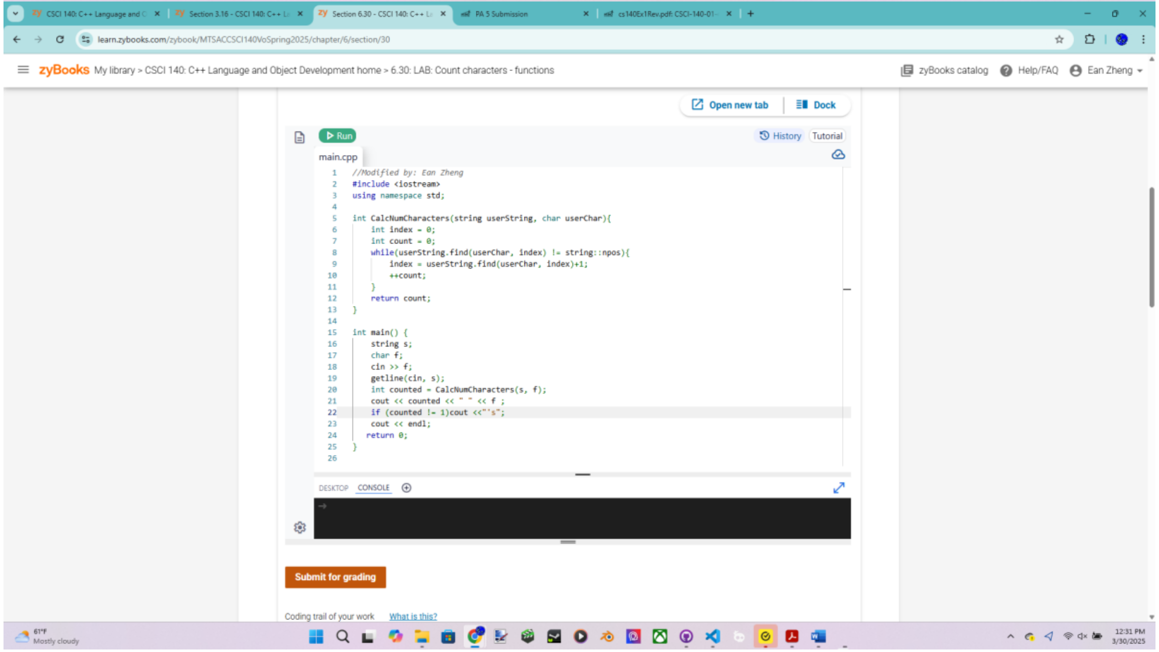
```
n Nobody
```

the output is:

```
0 n's
```

The program must define and call the following function that takes the input string and character as parameters, and returns the number of times the input character appears in the input string.

`int CalcNumCharacters(string userString, char userChar)`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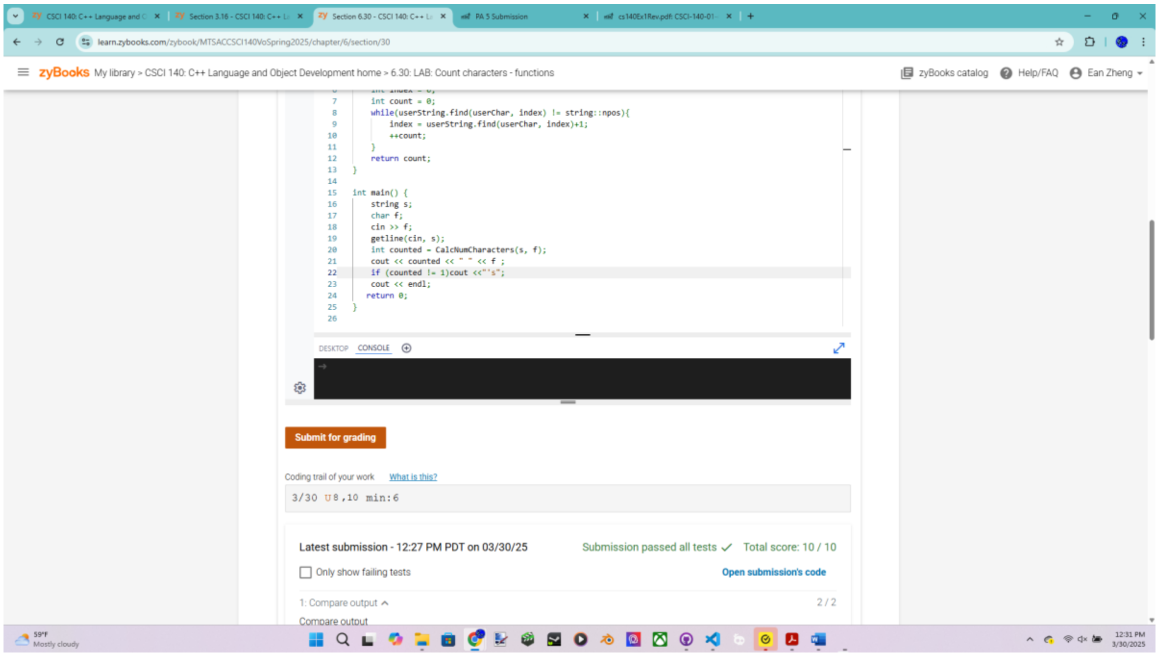
3/30/2025

```cpp
//Modified by: Ean Zheng
#include <iostream>
using namespace std;

int CalcNumCharacters(string userString, char userChar){
    int index = 0;
    int count = 0;
    while(userString.find(userChar, index) != string::npos){
        index = userString.find(userChar, index)+1;
        ++count;
    }
    return count;
}

int main() {
    string s;
    char f;
    cin >> f;
    getline(cin, s);
    int counted = CalcNumCharacters(s, f);
    cout << counted << " " << f ;
    if (counted != 1)cout <<"'s";
    cout << endl;
   return 0;
}

```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```
    int index = 0;
    int count = 0;
    while(userString.find(userChar, index) != string::npos){
        index = userString.find(userChar, index)+1;
        ++count;
    }
    return count;
}

int main() {
    string s;
    char f;
    cin >> f;
    getline(cin, s);
    int counted = CalcNumCharacters(s, f);
    cout << counted << " " << f ;
    if (counted != 1)cout <<"'s";
    cout << endl;
   return 0;
}
```

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Coding trail of your work What is this?

```
3/30 U8,10 min:6
```

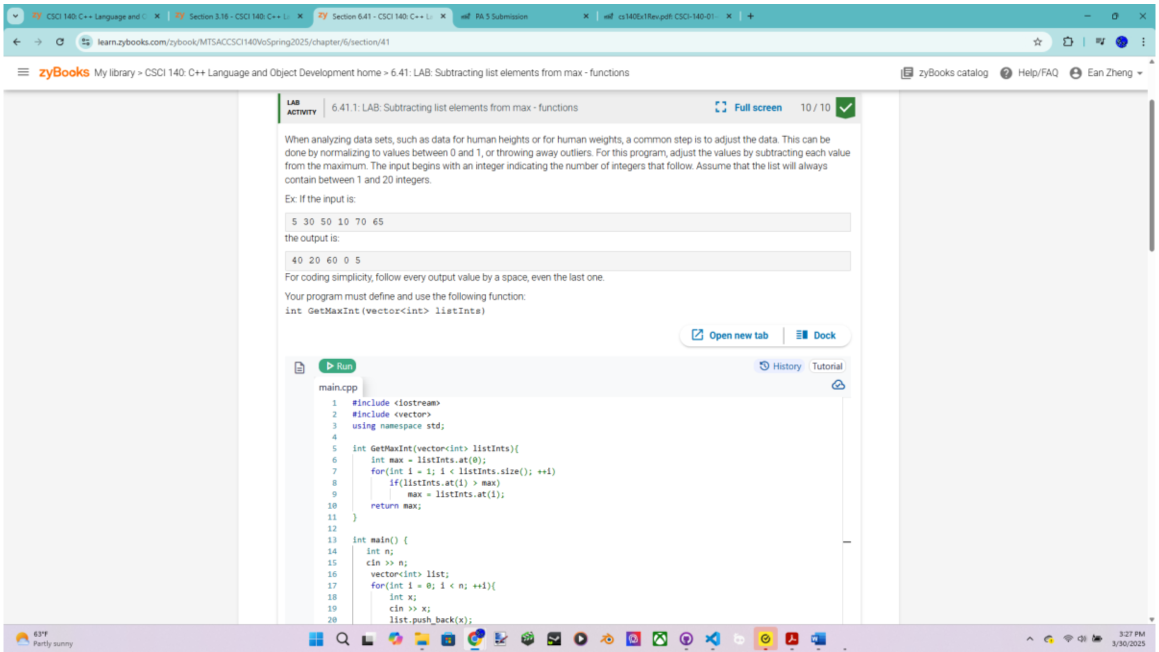
Latest submission - 12:27 PM PDT on 03/30/25 Submission passed all tests ✓ Total score: 10 / 10

□ Only show failing tests Open submission's code

1: Compare output ^ 2 / 2

Compare output

# Exercise 2 – 6.41 LAB: Subtracting list elements from max – functions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Run
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Tutorial
main.cpp
63°F Partly sunny
3:27 PM 3/30/2025

When analyzing data sets, such as data for human heights or for human weights, a common step is to adjust the data. This can be done by normalizing to values between 0 and 1, or throwing away outliers. For this program, adjust the values by subtracting each value from the maximum. The input begins with an integer indicating the number of integers that follow. Assume that the list will always contain between 1 and 20 integers.

Ex: If the input is:

```
5 30 50 10 70 65
```

the output is:

```
40 20 60 0 5
```

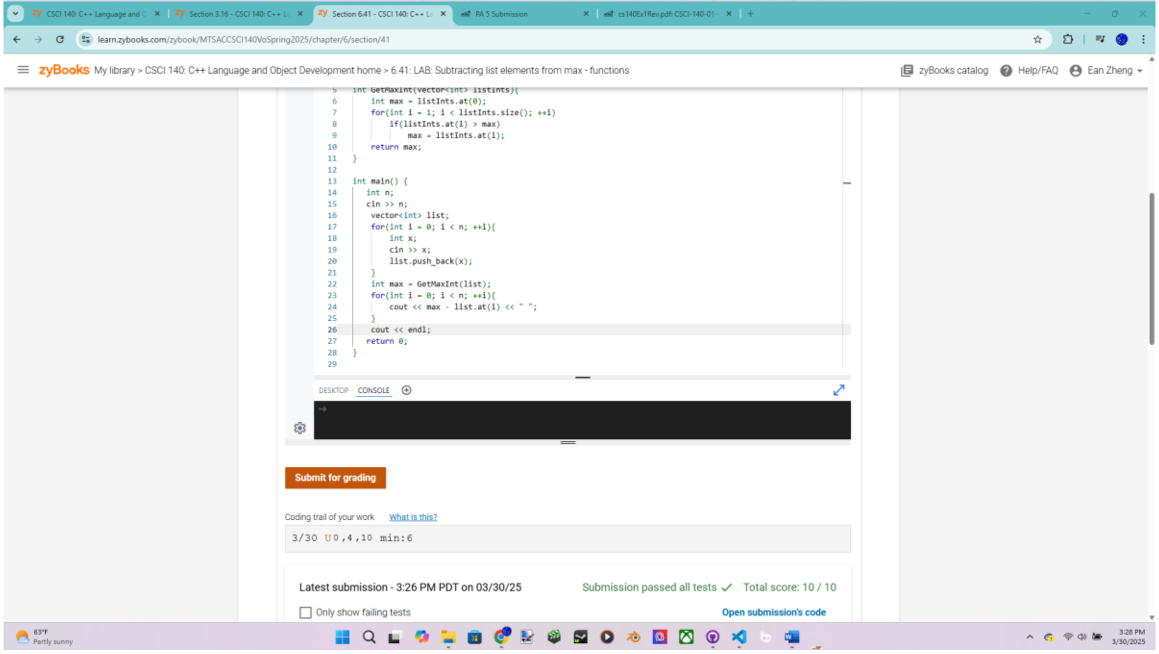
For coding simplicity, follow every output value by a space, even the last one.

Your program must define and use the following function:
`int GetMaxInt(vector<int> listInts)`

```
#include <iostream>
#include <vector>
using namespace std;

int GetMaxInt(vector<int> listInts){
    int max = listInts.at(0);
    for(int i = 1; i < listInts.size(); ++i)
        if(listInts.at(i) > max)
            max = listInts.at(i);
    return max;
}

int main() {
   int n;
   cin >> n;
    vector<int> list;
    for(int i = 0; i < n; ++i){
        int x;
        cin >> x;
        list.push_back(x);
```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```
int GetMaxInt(vector<int> listInts){
    int max = listInts.at(0);
    for(int i = 1; i < listInts.size(); ++i)
        if(listInts.at(i) > max)
            max = listInts.at(i);
    return max;
}

int main() {
   int n;
   cin >> n;
    vector<int> list;
    for(int i = 0; i < n; ++i){
        int x;
        cin >> x;
        list.push_back(x);
    }
    int max = GetMaxInt(list);
    for(int i = 0; i < n; ++i){
        cout << max - list.at(i) << " ";
    }
    cout << endl;
   return 0;
}
```

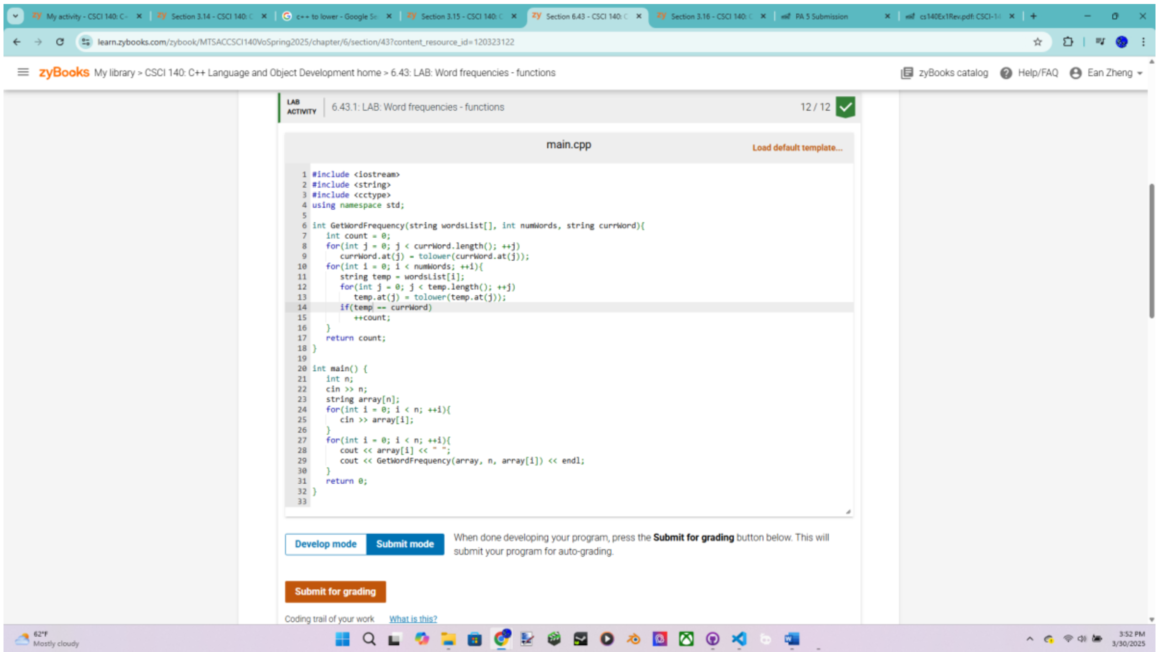
Coding trail of your work What is this?

```
3/30 U0,4,10 min:6
```

Latest submission - 3:26 PM PDT on 03/30/25   Submission passed all tests ✓   Total score: 10 / 10

□ Only show failing tests   Open submission's code

# Exercise 3 – 6.43 LAB: Word frequencies – functions (classic mode only)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LAB ACTIVITY
6.43.1: LAB: Word frequencies - functions
12 / 12
main.cpp
Load default template...
Develop mode
Submit mode
Submit for grading
Coding trail of your work
What is this?

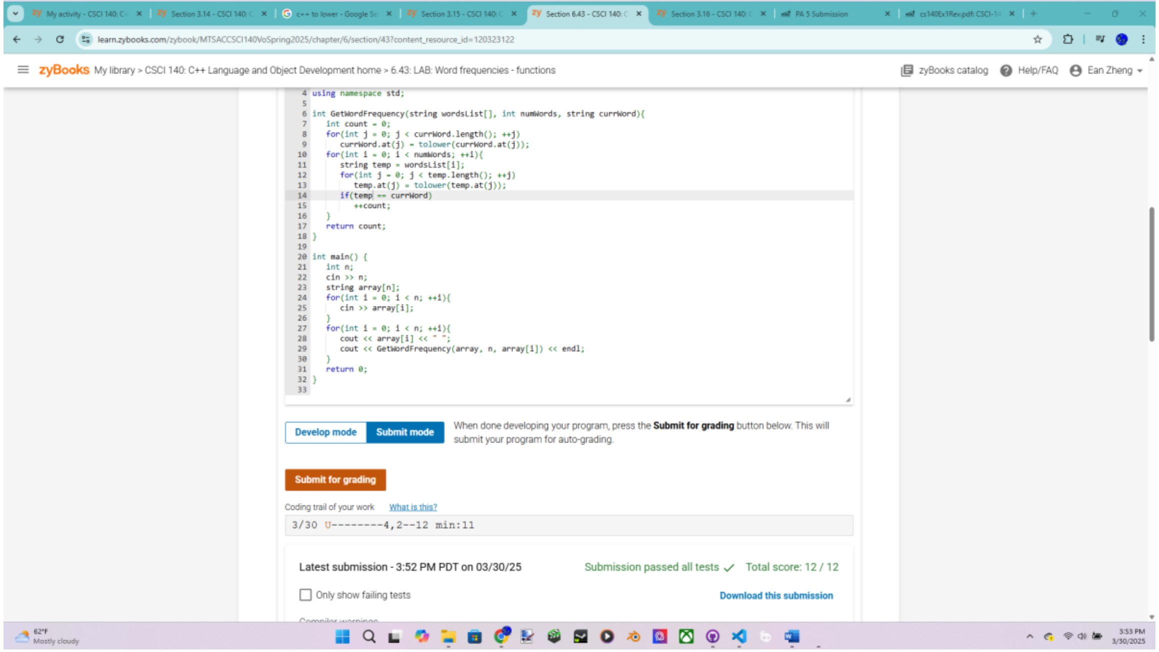
```cpp
#include <iostream>
#include <string>
#include <cctype>
using namespace std;

int GetWordFrequency(string wordsList[], int numWords, string currWord){
   int count = 0;
   for(int j = 0; j < currWord.length(); ++j)
      currWord.at(j) = tolower(currWord.at(j));
   for(int i = 0; i < numWords; ++i){
      string temp = wordsList[i];
      for(int j = 0; j < temp.length(); ++j)
         temp.at(j) = tolower(temp.at(j));
      if(temp == currWord)
         ++count;
   }
   return count;
}

int main() {
   int n;
   cin >> n;
   string array[n];
   for(int i = 0; i < n; ++i){
      cin >> array[i];
   }
   for(int i = 0; i < n; ++i){
      cout << array[i] << " ";
      cout << GetWordFrequency(array, n, array[i]) << endl;
   }
   return 0;
}

```

When done developing your program, press the **Submit for grading** button below. This will submit your program for auto-grading.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Develop mode
Submit mode
Submit for grading
Coding trail of your work
What is this?
Download this submission

```cpp
using namespace std;

int GetWordFrequency(string wordsList[], int numWords, string currWord){
   int count = 0;
   for(int j = 0; j < currWord.length(); ++j)
      currWord.at(j) = tolower(currWord.at(j));
   for(int i = 0; i < numWords; ++i){
      string temp = wordsList[i];
      for(int j = 0; j < temp.length(); ++j)
         temp.at(j) = tolower(temp.at(j));
      if(temp == currWord)
         ++count;
   }
   return count;
}

int main() {
   int n;
   cin >> n;
   string array[n];
   for(int i = 0; i < n; ++i){
      cin >> array[i];
   }
   for(int i = 0; i < n; ++i){
      cout << array[i] << " ";
      cout << GetWordFrequency(array, n, array[i]) << endl;
   }
   return 0;
}

```

When done developing your program, press the **Submit for grading** button below. This will submit your program for auto-grading.

```
3/30 U--------4,2--12 min:11
```

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Submission passed all tests ✓ Total score: 12 / 12

□ Only show failing tests

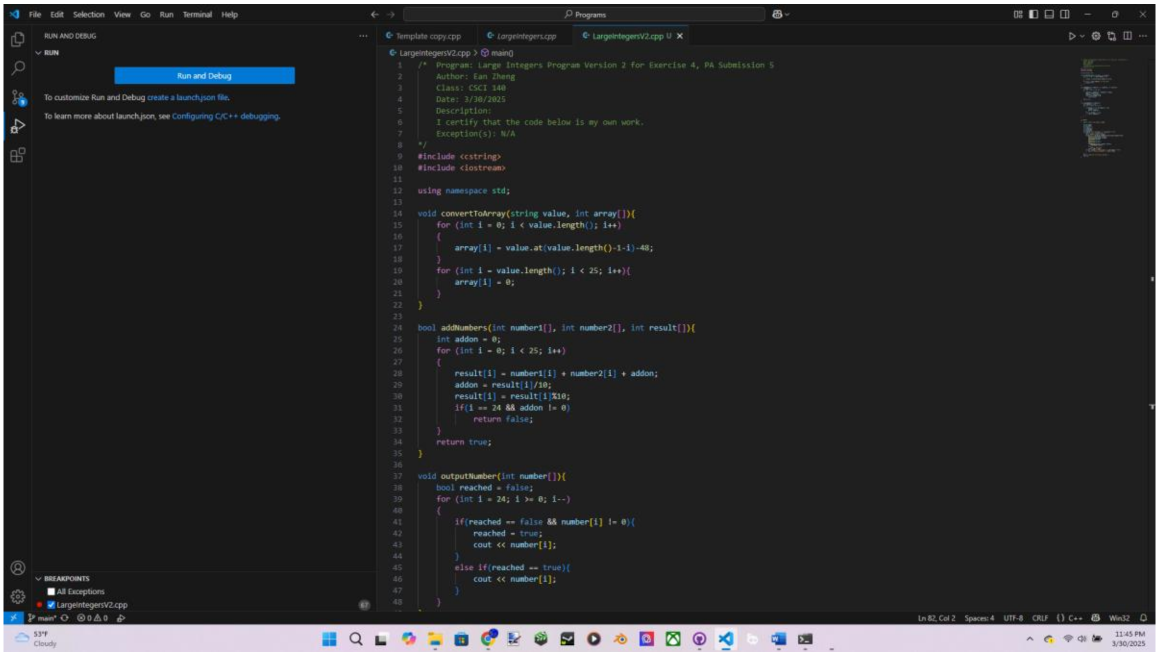
Exercise 4 – Large Integers version 2 – more points for this exercise
Modify your previous version to add two large integers and output the result if it is valid. You must utilize functions and here are the three required functions: convert an operand as string to an int array or an int vector, add valid operands (two big integers as two int arrays or two int vectors, one int array or an int vector as result, return true for valid operation and return false for overflow), and output one big integer in required format (big integer as one int array or an int vector). Think about the best way to set up these functions. Use a sentinel loop to stop the input where 0 % 0 is the sentinel value.

Source code below:

```
/*  Program: Large Integers Program Version 2 for Exercise 4, PA Submission 5
   Author: Ean Zheng
   Class: CSCI 140
   Date: 3/30/2025
   Description:
   I certify that the code below is my own work.
   Exception(s): N/A
*/
#include <cstring>
#include <iostream>

using namespace std;

void convertToArray(string value, int array[]){
   for (int i = 0; i < value.length(); i++)
   {
      array[i] = value.at(value.length()-1-i)-48;
   }
   for (int i = value.length(); i < 25; i++){
      array[i] = 0;
   }
}

bool addNumbers(int number1[], int number2[], int result[]){
   int addon = 0;
   for (int i = 0; i < 25; i++)
   {
      result[i] = number1[i] + number2[i] + addon;
      addon = result[i]/10;
      result[i] = result[i]%10;
      if(i == 24 && addon != 0)
         return false;
   }
   return true;
}
```

```
void outputNumber(int number[]){
    bool reached = false;
    for (int i = 24; i >= 0; i--)
    {
        if(reached == false && number[i] != 0){
            reached = true;
            cout << number[i];
        }
        else if(reached == true){
            cout << number[i];
        }
    }
}

int main()
{
    cout << "Author: Ean Zheng" << endl;

    string value1;
    string value2;
    char sign = ' ';
    int array1[25];
    int array2[25];
    int result[25];
    while(value1 != "0" && sign != '%' && value2 != "0"){
        cout << "Enter an expression --> ";
        cin >> value1 >> sign >> value2;
        if(sign == '+' && value1.length()<=25 && value2.length()<=25){
            convertToArray(value1, array1);
            convertToArray(value2, array2);
            outputNumber(array1);
            cout << " + ";
            outputNumber(array2);
            cout << " = ";
            if(addNumbers(array1, array2, result))
                outputNumber(result);
            else
                cout << "overflow";
            cout << endl << endl;
        }else if (value1 != "0" && sign != '%' && value2 != "0"){
            cout << "Invalid operand(s)" << endl << endl;
        }
    }
    cout << "Thank you for using my program.";
    return 0;
```

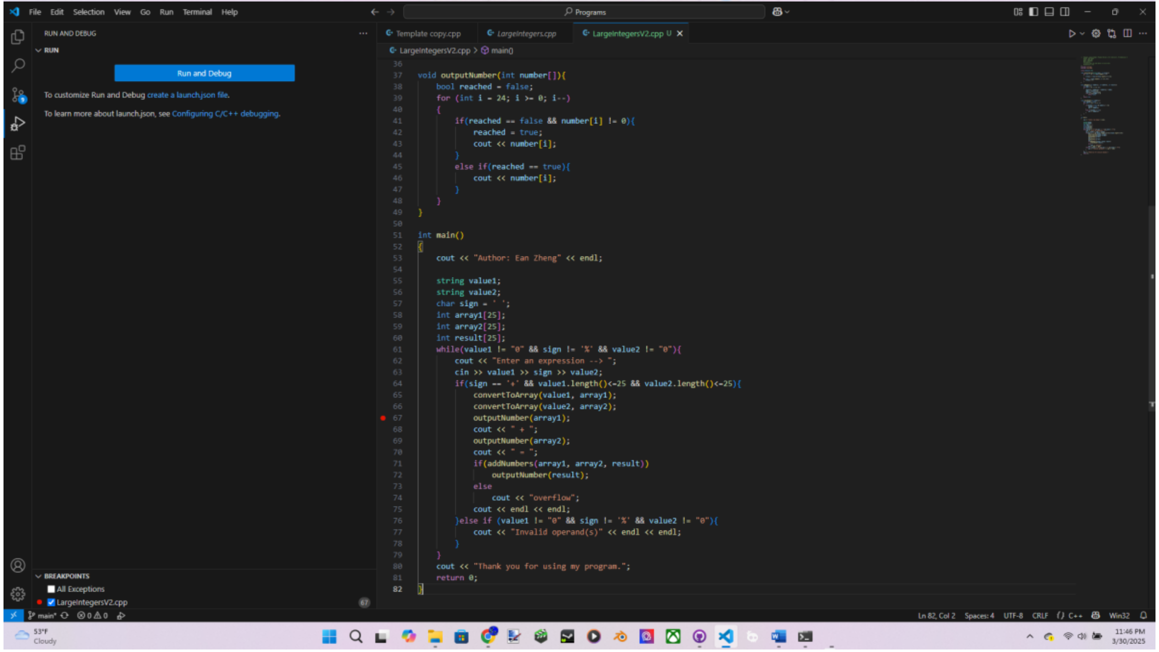
}



To customize Run and Debug create a launch.json file.

To learn more about launch.json, see Configuring C/C++ debugging.

```cpp
/*  Program: Large Integers Program Version 2 for Exercise 4, PA Submission 5
    Author: Ean Zheng
    Class: CSCI 140
    Date: 3/30/2025
    Description:
    I certify that the code below is my own work.
    Exception(s): N/A
*/
#include <cstring>
#include <iostream>

using namespace std;

void convertToArray(string value, int array[]){
    for (int i = 0; i < value.length(); i++)
    {
        array[i] = value.at(value.length()-1-i)-48;
    }
    for (int i = value.length(); i < 25; i++){
        array[i] = 0;
    }
}

bool addNumbers(int number1[], int number2[], int result[]){
    int addon = 0;
    for (int i = 0; i < 25; i++)
    {
        result[i] = number1[i] + number2[i] + addon;
        addon = result[i]/10;
        result[i] = result[i]%10;
        if(i == 24 && addon != 0)
            return false;
    }
    return true;
}

void outputNumber(int number[]){
    bool reached = false;
    for (int i = 24; i >= 0; i--)
    {
        if(reached == false && number[i] != 0){
            reached = true;
            cout << number[i];
        }
        else if(reached == true){
            cout << number[i];
        }
    }
```



To customize Run and Debug create a launch.json file.

To learn more about launch.json, see Configuring C/C++ debugging.

```cpp

void outputNumber(int number[]){
    bool reached = false;
    for (int i = 24; i >= 0; i--)
    {
        if(reached == false && number[i] != 0){
            reached = true;
            cout << number[i];
        }
        else if(reached == true){
            cout << number[i];
        }
    }
```

```cpp
}

int main()
{
    cout << "Author: Ean Zheng" << endl;

    string value1;
    string value2;
    char sign = ' ';
    int array1[25];
    int array2[25];
    int result[25];
    while(value1 != "0" && sign != '%' && value2 != "0"){
        cout << "Enter an expression --> ";
        cin >> value1 >> sign >> value2;
        if(sign == '+' && value1.length()<=25 && value2.length()<=25){
            convertToArray(value1, array1);
            convertToArray(value2, array2);
            outputNumber(array1);
            cout << " + ";
            outputNumber(array2);
            cout << " = ";
            if(addNumbers(array1, array2, result))
                outputNumber(result);
            else
                cout << "overflow";
            cout << endl << endl;
        }else if (value1 != "0" && sign != '%' && value2 != "0"){
            cout << "Invalid operand(s)" << endl << endl;
        }
    }
    cout << "Thank you for using my program.";
    return 0;
}
```

Input/output below:

Author: Ean Zheng
Enter an expression --> 1234 + 72
1234 + 72 = 1306

Enter an expression --> 987654321 + 123456789
987654321 + 123456789 = 1111111110

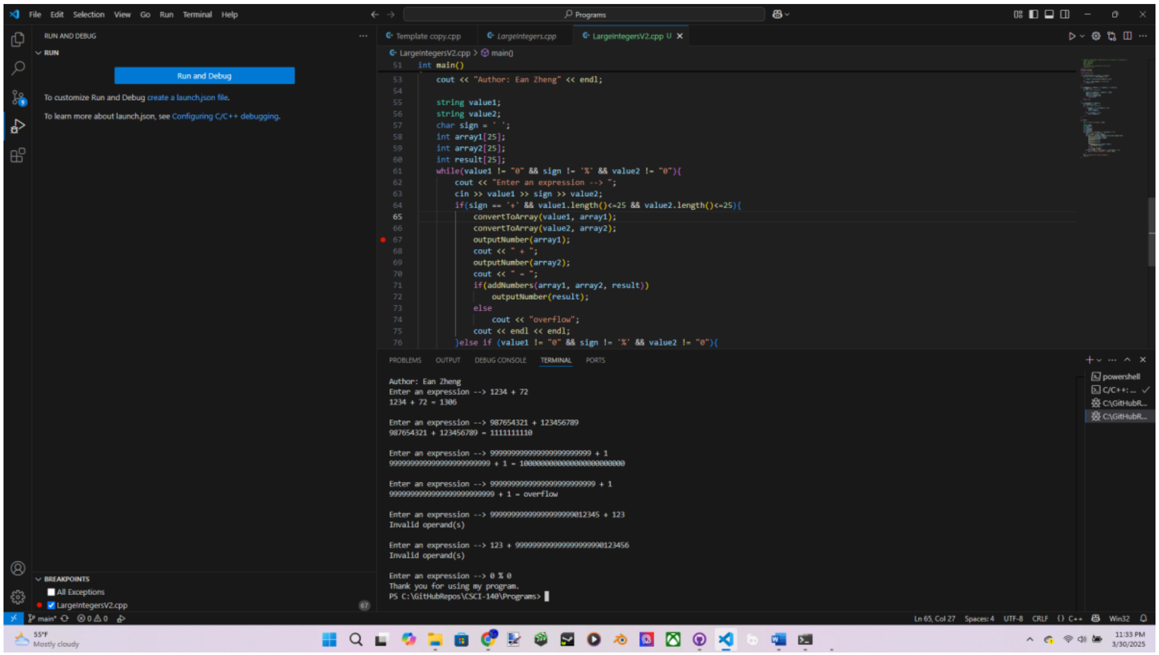
Enter an expression --> 9999999999999999999999999 + 1
9999999999999999999999999 + 1 = 10000000000000000000000000

Enter an expression --> 99999999999999999999999999 + 1
99999999999999999999999999 + 1 = overflow

Enter an expression --> 99999999999999999999012345 + 123
Invalid operand(s)

Enter an expression --> 123 + 99999999999999999999990123456
Invalid operand(s)

Enter an expression --> 0 % 0
Thank you for using my program.



To customize Run and Debug create a launch.json file.

To learn more about launch.json, see Configuring C/C++ debugging.

```
int main()
    cout << "Author: Ean Zheng" << endl;

    string value1;
    string value2;
    char sign = ' ';
    int array1[25];
    int array2[25];
    int result[25];
    while(value1 != "0" && sign != '%' && value2 != "0"){
        cout << "Enter an expression --> ";
        cin >> value1 >> sign >> value2;
        if(sign == '+' && value1.length()<=25 && value2.length()<=25){
            convertToArray(value1, array1);
            convertToArray(value2, array2);
            outputNumber(array1);
            cout << " + ";
            outputNumber(array2);
            cout << " = ";
            if(addNumbers(array1, array2, result))
                outputNumber(result);
            else
                cout << "overflow";
            cout << endl << endl;
        }else if (value1 != "0" && sign != '%' && value2 != "0"){
```

```
Author: Ean Zheng
Enter an expression --> 1234 + 72
1234 + 72 = 1306

Enter an expression --> 987654321 + 123456789
987654321 + 123456789 = 1111111110

Enter an expression --> 9999999999999999999999999 + 1
9999999999999999999999999 + 1 = 10000000000000000000000000

Enter an expression --> 99999999999999999999999999 + 1
99999999999999999999999999 + 1 = overflow

Enter an expression --> 99999999999999999999012345 + 123
Invalid operand(s)

Enter an expression --> 123 + 99999999999999999999990123456
Invalid operand(s)

Enter an expression --> 0 % 0
Thank you for using my program.
PS C:\GitHubRepos\CSCI-140\Programs> 
```

Question 1: List some good reasons for creating and using functions in C++ programs.

To make the program more understandable and readable, prevent repetitive code usage, reduce lines of code, and to just make coding easier and more convenient in general.

Question 2: Why is it not a good idea to output a calculated result inside a calculated function that returns the calculated result?

Getting the result from the returning function in the main program is more convenient and allows further use, while also most likely requiring less code lines. It is also a good habit to restrict output statements to the main program if you can.

Extra Credit (2 points): Modify Exercise 4 so you can also perform subtraction with large number as well by adding a function sub (subtracting one big integer from a big integer as two int arrays, one int array as result, return true for valid operation, and return false when first operand is less than second operand). You can submit just this version, but make sure to show test cases for both addition and subtraction. Follow the interface below and you must try the following test cases:

```
Enter an expression --> 1234 - 72<Enter>
1234 - 72 = 1162
Enter an expression --> 72 - 1234<Enter>
72 - 1234 = result is negative
Enter an expression --> 100 - 105<Enter>
100 - 105 = result is negative
Enter an expression --> 987654321 - 123456789<Enter>
987654321 - 123456789 = 864197532
Enter an expression --> 12345 - 12345<Enter>
12345 - 12345 = 0
// 25 digits - 1 digit = 25 digits
Enter an expression --> 9999999999999999999999999 - 1<Enter>
9999999999999999999999999 - 1 = 9999999999999999999999998
Enter an expression --> 0 % 0<Enter>
Thank you for using my program.
```

Source Code:

```
/*  Program: Large Integers Program Version 2 for Exercise 4, PA Submission 5
    Author: Ean Zheng
    Class: CSCI 140
    Date: 3/30/2025
    Description:
    I certify that the code below is my own work.
    Exception(s): N/A
*/
#include <cstring>
#include <iostream>
#include <cmath>

using namespace std;

void convertToArray(string value, int array[]){
    for (int i = 0; i < value.length(); i++)
    {
        array[i] = value.at(value.length()-1-i)-48;
    }
    for (int i = value.length(); i < 25; i++){
        array[i] = 0;
    }
```

```
}

bool addNumbers(int number1[], int number2[], int result[]){
    int addon = 0;
    for (int i = 0; i < 25; i++)
    {
        result[i] = number1[i] + number2[i] + addon;
        addon = result[i]/10;
        result[i] = result[i]%10;
        if(i == 24 && addon != 0)
            return false;
    }
    return true;
}

bool subtractNumbers(int number1[], int number2[], int result[]){
    int subon = 0;
    for (int i = 0; i < 25; i++)
    {
        result[i] = number1[i] - number2[i] - subon;
        if(result[i] < 0){
            subon = abs(floor(result[i]/10.0));
            result[i] = 10 + result[i];
        }else
            subon = 0;
        if(i == 24 && subon != 0)
            return false;
    }
    return true;
}

void outputNumber(int number[]){
    bool reached = false;
    for (int i = 24; i >= 0; i--)
    {
        if(reached == false && number[i] != 0){
            reached = true;
            cout << number[i];
        }
        else if(reached == true){
            cout << number[i];
        }
        if (reached == false && i == 0){
            cout << 0;
        }
    }
```

```
}

int main()
{
    cout << "Author: Ean Zheng" << endl;

    string value1;
    string value2;
    char sign = ' ';
    int array1[25];
    int array2[25];
    int result[25];
    while(value1 != "0" && sign != '%' && value2 != "0"){
        cout << "Enter an expression --> ";
        cin >> value1 >> sign >> value2;
        if(sign == '+' && value1.length()<=25 && value2.length()<=25){
            convertToArray(value1, array1);
            convertToArray(value2, array2);
            outputNumber(array1);
            cout << " + ";
            outputNumber(array2);
            cout << " = ";
            if(addNumbers(array1, array2, result))
                outputNumber(result);
            else
                cout << "overflow";
            cout << endl << endl;
        }else if(sign == '-' && value1.length()<=25 && value2.length()<=25){
            convertToArray(value1, array1);
            convertToArray(value2, array2);
            outputNumber(array1);
            cout << " - ";
            outputNumber(array2);
            cout << " = ";
            if(subtractNumbers(array1, array2, result))
                outputNumber(result);
            else
                cout << "result is negative";
            cout << endl << endl;
        }else if (value1 != "0" && sign != '%' && value2 != "0"){
            cout << "Invalid operand(s)" << endl << endl;
        }
    }
    cout << "Thank you for using my program.";
    return 0;
}
```

Input/Output:

Author: Ean Zheng
Enter an expression --> 1234 - 72
1234 - 72 = 1162

Enter an expression --> 72 - 1234
72 - 1234 = result is negative

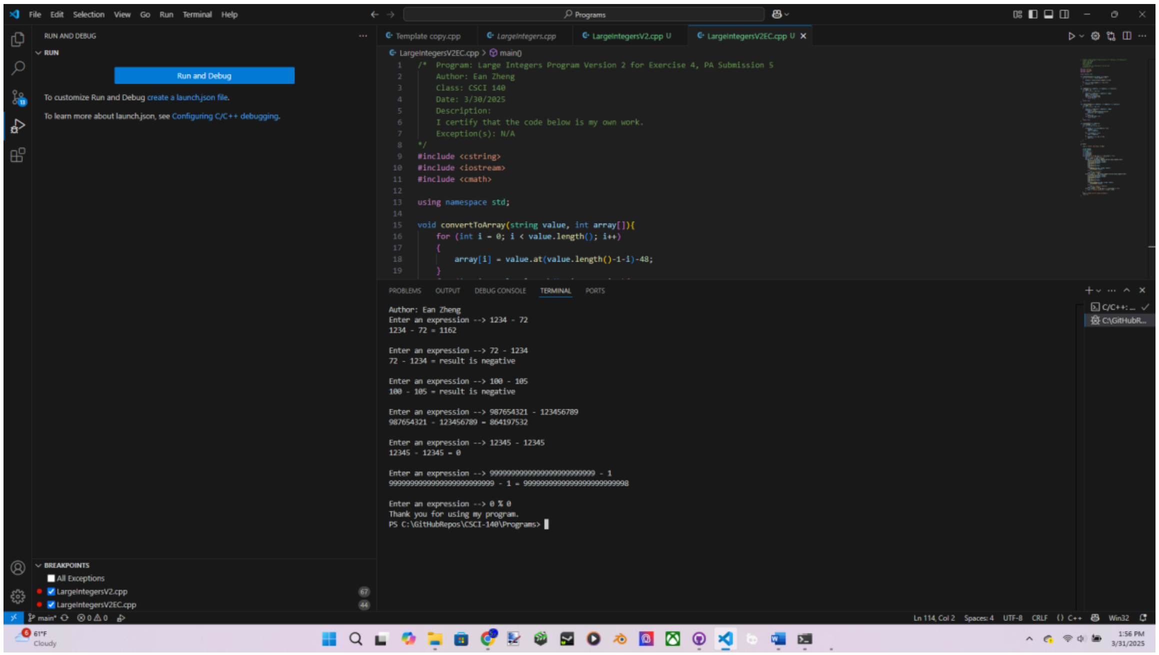
Enter an expression --> 100 - 105
100 - 105 = result is negative

Enter an expression --> 987654321 - 123456789
987654321 - 123456789 = 864197532

Enter an expression --> 12345 - 12345
12345 - 12345 = 0

Enter an expression --> 9999999999999999999999999 - 1
9999999999999999999999999 - 1 = 9999999999999999999999998

Enter an expression --> 0 % 0
Thank you for using my program.



```cpp
/*  Program: Large Integers Program Version 2 for Exercise 4, PA Submission 5
    Author: Ean Zheng
    Class: CSCI 140
    Date: 3/30/2025
    Description:
    I certify that the code below is my own work.
    Exception(s): N/A
*/
#include <cstring>
#include <iostream>
#include <cmath>

using namespace std;

void convertToArray(string value, int array[]){
    for (int i = 0; i < value.length(); i++)
    {
        array[i] = value.at(value.length()-1-i)-48;
    }
```

```
Author: Ean Zheng
Enter an expression --> 1234 - 72
1234 - 72 = 1162

Enter an expression --> 72 - 1234
72 - 1234 = result is negative

Enter an expression --> 100 - 105
100 - 105 = result is negative

Enter an expression --> 987654321 - 123456789
987654321 - 123456789 = 864197532

Enter an expression --> 12345 - 12345
12345 - 12345 = 0

Enter an expression --> 9999999999999999999999999 - 1
9999999999999999999999999 - 1 = 9999999999999999999999998

Enter an expression --> 0 % 0
Thank you for using my program.
PS C:\GitHubRepos\CSCI-140\Programs>
```