CSC 150 LAB 5-1 STRING TO NUMERIC CONVERSIONS

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1. NUMERIC TO STRING CONVERSION

The digits that make up numbers are usually thought of as the characters '0', '1', ..., '9', but we will continue to think of them as integers.

In previous labs, you learned how to convert an integer into a sequence (vector) of digits. For example, given an integer 527, you were able to compute the vector $[7, 2, 5]$. Notice that the digits were placed into the vector in increasing order of significance: 7, the units digit, is placed into the vector first, then 2, the tens digits, is placed next, then finally, 5 the hundreds digit, is placed into the vector.

But increasing order of significance is not how we think of the sequence of digits of a decimal number. We would like the decimal digits to be placed in decreasing order of significance: with the most significant digit going in first. Thus, if we are converting 527, we should finish with the vector $[5, 2, 7]$.

If we use recursion, we can do this as follows. In a recursive function, we can wait to add the least significant digit (7) at the end of the vector until we have recursively converted the number that consisting of the rest of the digits (52). Implement this by completing the following shell program.

```
#include <iostream>
#include <string>
#include <vector>

using namespace std;

/*
  Adds the decimal digits that make up number to the vector digits
  in increasing order of significance.
  Assumes number > 0. Base case is when number == 0 in which case
  no digits are added to the vector
*/
void decimal_digits(int number, vector<int>& digits)
{


}

/*
  Output the vector
*/
void output(vector<int> vec)
{
```

```
}

int main()
{
    vector<int> digits_vector;
    int number;
    cout << "Enter a number: ";
    cin >> number;
    cout << "The vector of digits is ";
    // decimal_digits here


    output(digits_vector);
    cout << endl;
}
```

Here is a sample output

```
Enter a number: 5208
The vector of digits is [5, 2, 0, 8]
```

2. String to Numeric Conversion

Given a vector of digits such as [5, 2, 7] we can convert it to the equivalent number, 527, as follows. Begin with the most significant digit, 5. Multiply by 10, getting 50. Add the next digit, 2, getting 52. Multiply by 10, getting 520. Add the next digit, 7. There are no more digits, so we stop.

Use this strategy, to write a function that converts a vector of digits to the equivalent number and returns that number:

```
int number_from_digits(vector<int> digits)
{
    return 0;
}
```

Test your function by reading in a number, converting it to digits, printing the digits, converting the digits back to a number by calling number_from_digits, and printing the result. Your run should look like this

```
Enter a number: 4509
The vector of digits is [4, 5, 0, 9]
The vector of digits converted back to an integer is 4509
```

3. Binary Conversions

Decimal numbers are built out of the 10 decimal digits 0, 1, ..., 9 with each digit of a number being weighted by a power of 10 according to its position, counting from right to left.

$$50237 = 5 \times 10^4 + 0 \times 10^3 + 2 \times 10^2 + 3 \times 10^1 + 7 \times 10^0$$

Binary numbers are similar, except they are built out the 2 binary digits 0 and 1, with each binary digit (bit) being weighted by a power of 2 according to its position. For example, the binary number 101011 represents the number

$$43 = 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

Modify your program by adding more functions, or by changing the functions you have, so that when a user enters an integer, it is processed for both decimal and binary conversions. You will also need to make the necessary changes to the main function.

Here is what a sample output should look like.

```
Enter a number: 43
The vector of decimal digits is [4, 3]
The vector of digits converted back to an integer is 43
The vector of binary digits is [1, 0, 1, 0, 1, 1]
The vector of digits converted back to an integer is 43
```

4. Due Date

This lab is due Thursday of Week 5.