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### Project #1

#### **Design:**

The program is a simple C++ executable which asks the user for an integer number which will be the number used for the shifting process in the Caesar cipher, and a string, which will be the input for the encryption process. Two for loops are then used for the encryption and decryption processes respectively, with outputs displayed afterwards accordingly. The loops both iterate over the length of the input string, and check for the case of each character in the string before applying the shift. This is because in the ASCII standard (used by C++), upper case characters are encoded by the numbers 65–90, and lower case characters are encoded by the numbers 97–122. We don't want the output strings of these for loops to be outside of the appropriate ranges for the cases in the ASCII standard otherwise we would have some non-alphabetical character in the output.

I chose C++ as the language for writing this program because C++ is a part of the C-family of languages. A particular strength of these languages, over other comparable languages such as Java, is that they allow for direct manipulation of the computer's memory with the use of an allocation function, and also through the use of pointers. These features allow the programmer to have better control over the data in memory utilized by the program, and not allow outside interference.

## Code:

```
#include <iostream>

using namespace std;

int main() {

    int shift;
    string input;
    string encryptionResult = "";
    string decryptionResult = "";

    cout << "Enter number to shift by in encryption process: ";
    cin >> shift;

    cout << "\nEnter string to be encrypted: ";
    cin >> input;

    for(int i = 0; i < input.length(); i++){

        if(isupper(input[i]))
            encryptionResult += (input[i] + shift - 65)%26 + 65;
        else if (input[i] == ' ')
            encryptionResult += ' ';
        else
            encryptionResult += (input[i] + shift - 97)%26 + 97;
    }

    cout << "\nEncryption Result: " << encryptionResult << "\n";

    for(int i = 0; i < input.length(); i++){

        if(isupper(input[i]))
            decryptionResult += (encryptionResult[i] + (26 - shift) - 65)%26
            + 65;
        else if (input[i] == ' ')
            decryptionResult += ' ';
        else
            decryptionResult += (encryptionResult[i] + (26 - shift) - 97)%26
            + 97;
    }

    cout << "\nDecryption Result: " << decryptionResult << "\n";

    return 0;
}
```

## Output:

```
Enter number to shift by in encryption process: 5
Enter string to be encrypted: hello
Encryption Result: mjqqt
Decryption Result: hello
Process returned 0 (0x0)   execution time : 13.840 s
Press any key to continue.
```

```
Enter number to shift by in encryption process: 8
Enter string to be encrypted: california
Encryption Result: kitqnwzvqi
Decryption Result: california
Process returned 0 (0x0)   execution time : 43.944 s
Press any key to continue.
```