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Batch: C32
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Experiment No 2

Aim: Implementation of Ceaser Cipher.

Description:

- The Caesar cipher is a simple encryption technique that was used by Julius Caesar to send secret messages to his allies. It works by shifting the letters in the plaintext message by a certain number of positions, known as the “shift” or “key”.
- The Caesar Cipher technique is one of the earliest and simplest methods of encryption technique. It’s simply a type of substitution cipher, i.e., each letter of a given text is replaced by a letter with a fixed number of positions down the alphabet. For example with a shift of 1, A would be replaced by B, B would become C, and so on. The method is named after Julius Caesar, who used it to communicate with his officials.
- Thus to cipher a given text we need an integer value, known as a shift which indicates the number of positions each letter of the text has been moved down.
- The encryption can be represented using modular arithmetic by first transforming the letters into numbers, according to the scheme, A = 0, B = 1,…, Z = 25. Encryption of a letter by a shift n can be described mathematically as.
- For example, if the shift is 3, then the letter A would be replaced by the letter D, B would become E, C would become F, and so on. The alphabet is wrapped around so that after Z, it starts back at A.
- Here is an example of how to use the Caesar cipher to encrypt the message “HELLO” with a shift of 3:

1. Write down the plaintext message: HELLO
2. Choose a shift value. In this case, we will use a shift of 3.
3. Replace each letter in the plaintext message with the letter that is three positions to the right in the alphabet.

H becomes K (shift 3 from H)
E becomes H (shift 3 from E)
L becomes O (shift 3 from L)
L becomes O (shift 3 from L)
O becomes R (shift 3 from O)

4. The encrypted message is now “KHOOR”.

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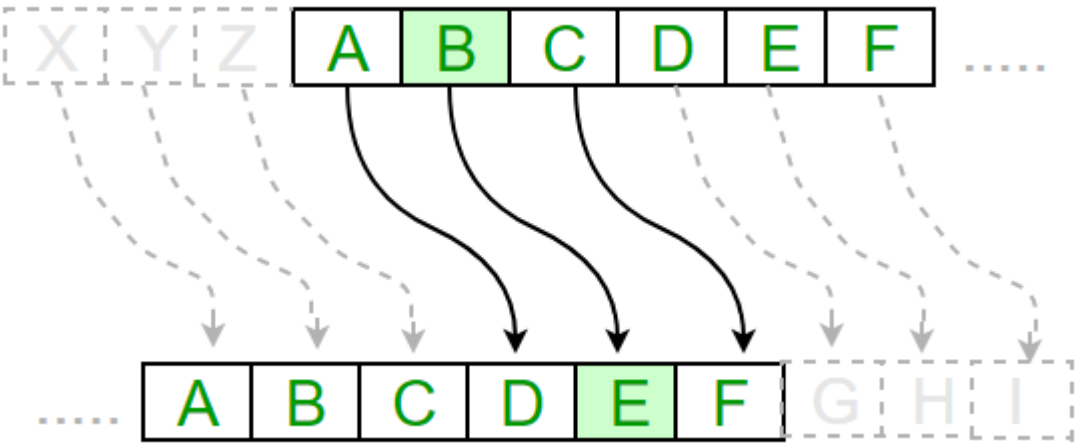
To decrypt the message, you simply need to shift each letter back by the same number of positions. In this case, you would shift each letter in “KHOOR” back by 3 positions to get the original message, “HELLO”.

$E_n(x)=(x+n) \mod 26$
(Encryption Phase with shift n)

$D_n(x)=(x-n) \mod 26$
(Decryption Phase with shift n)



Text: ABCDEFGHIJKLMNOPQRSTUVWXYZ
Shift: 23
Cipher: XYZABCDEFGHIJKLMNOPQRSTUVW

Advantages:

1. Easy to implement and use thus, making suitable for beginners to learn about encryption.
2. Can be physically implemented, such as with a set of rotating disks or a set of cards, known as a scytale, which can be useful in certain situations.
3. Requires only a small set of pre-shared information.
4. Can be modified easily to create a more secure variant, such as by using multiple shift values or keywords.

Disadvantages:

1. It is not secure against modern decryption methods.
2. Vulnerable to known-plaintext attacks, where an attacker has access to both the encrypted and unencrypted versions of the same messages.

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3. The small number of possible keys means that an attacker can easily try all possible keys until the correct one is found, making it vulnerable to a brute-force attack.

Code:

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

string encrypt(const string &text, int shift) {
  string result = "";

  for (char ch : text) {
    if (isalpha(ch)) {
      char base = isupper(ch) ? 'A' : 'a';
      result += static_cast<char>((ch - base + shift) % 26 + base);
    } else {
      result += ch;
    }
  }
  return result;
}

int main() {
  string plaintext;
  int shift;

  cout << "Enter the text to encrypt: ";
  getline(cin, plaintext);

  cout << "Enter the shift value: ";
  cin >> shift;

  string ciphertext = encrypt(plaintext, shift);

  cout << "Encrypted text: " << ciphertext << endl;

  return 0;
}
```

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Results:

```
Enter the text to encrypt: strength
Enter the shift value: 5
Encrypted text: xywjslym
```