Introducing the Caesar cipher

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The Caesar Cipher

- Finally, we’re ready to implement our first cipher
- A substitution cipher - each letter in the input text is replaced by another according to a constant rule
- Named after Julius Caesar - the first recorded user of this cipher!

Caesar Cipher Encryption Substitution Rule

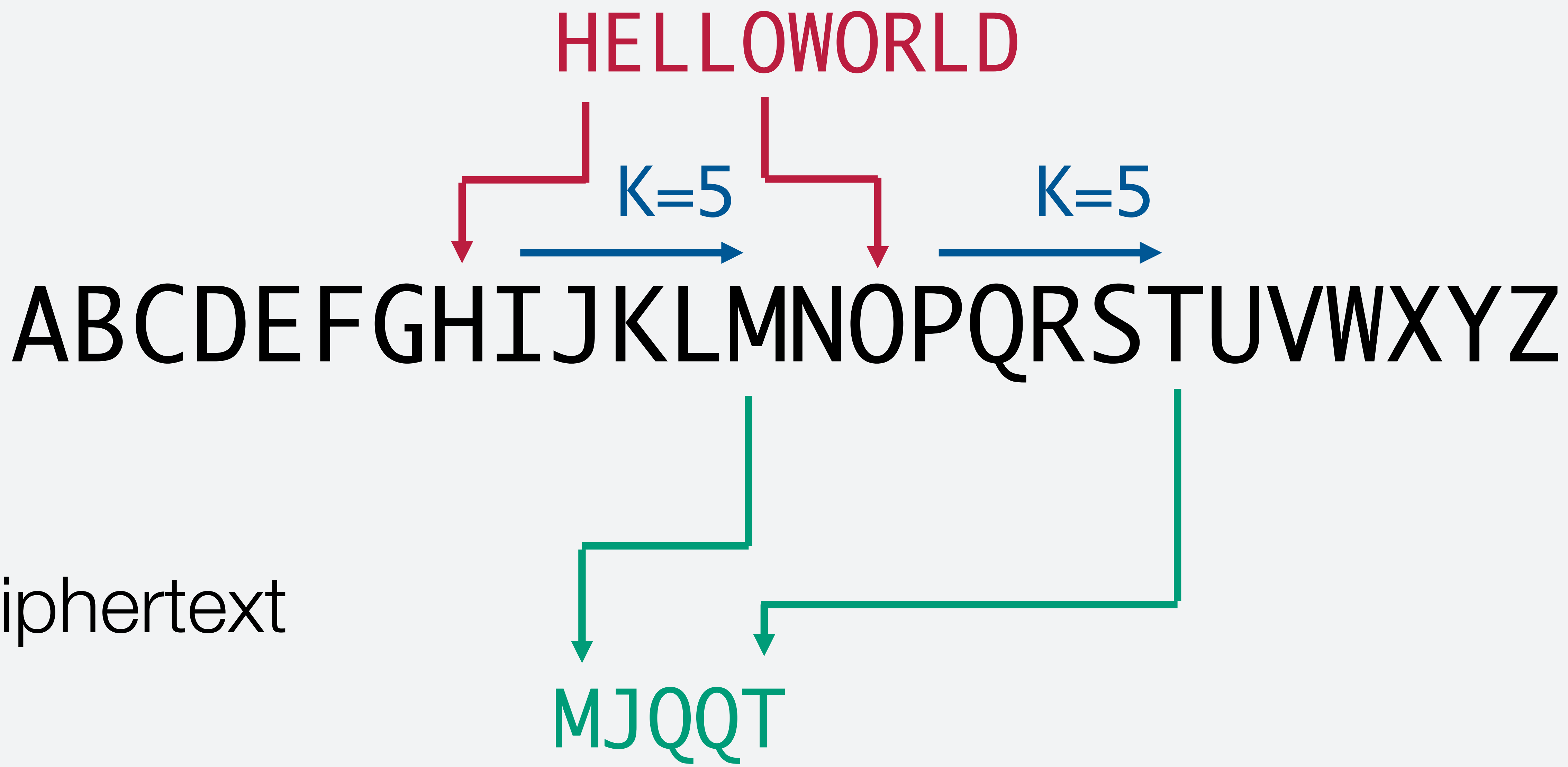
- Replace each letter in Plaintext string by that *K* letters **rightward** in the **Alphabet**.

- If the shift goes beyond the end of the **Alphabet**, wrap around to ‘A’ and continue counting **rightwards**.

- Shift *K* is an integer [0,25] and is the **Key** for the cipher

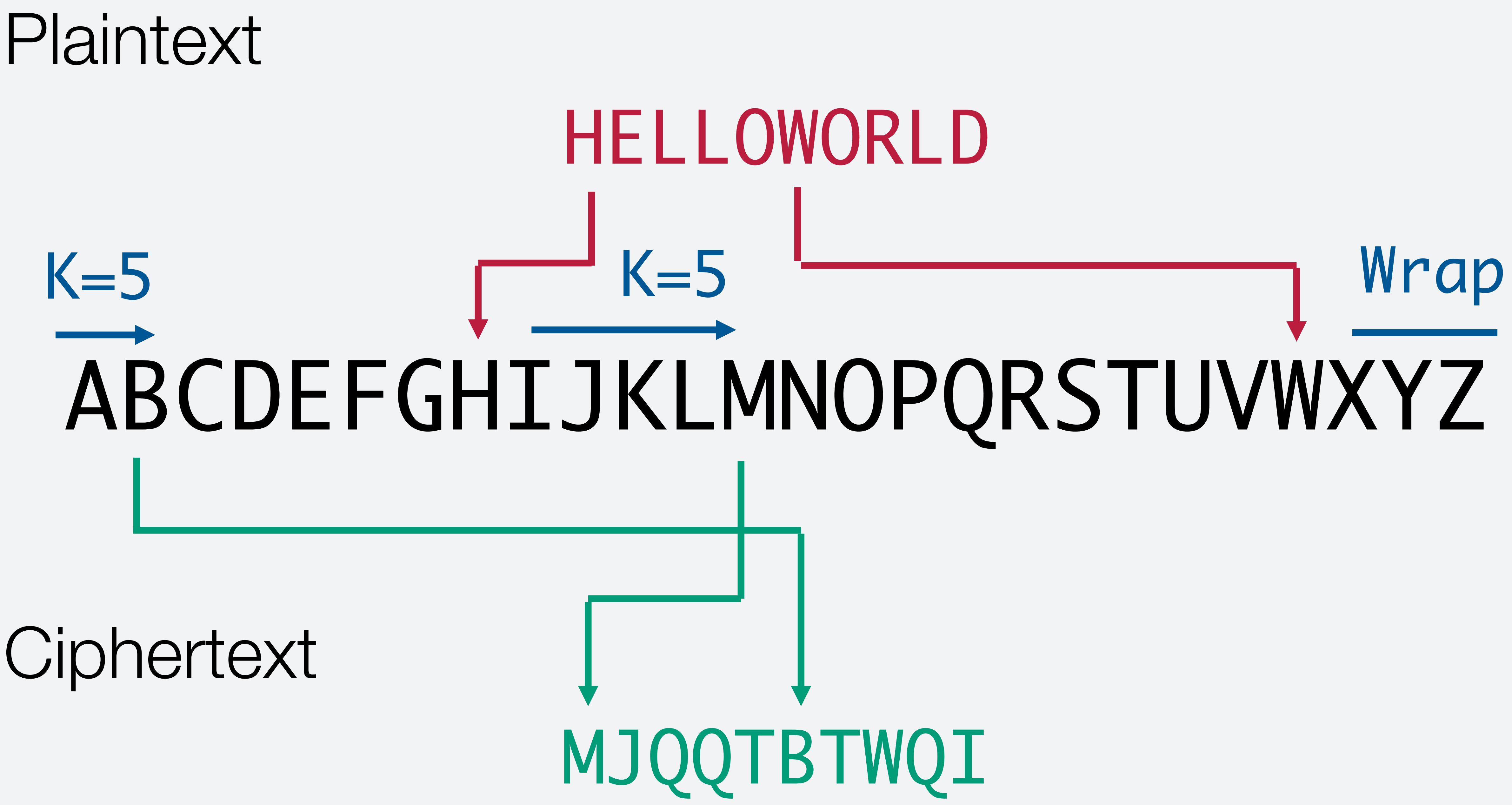
Encrypting With the Caesar Cipher, K=5

Plaintext



Ciphertext

Encrypting With the Caesar Cipher, K=5



Caesar Cipher Decryption Substitution Rule

- Replace each letter in CipherText by that *K* letters **leftward** in the **Alphabet**.

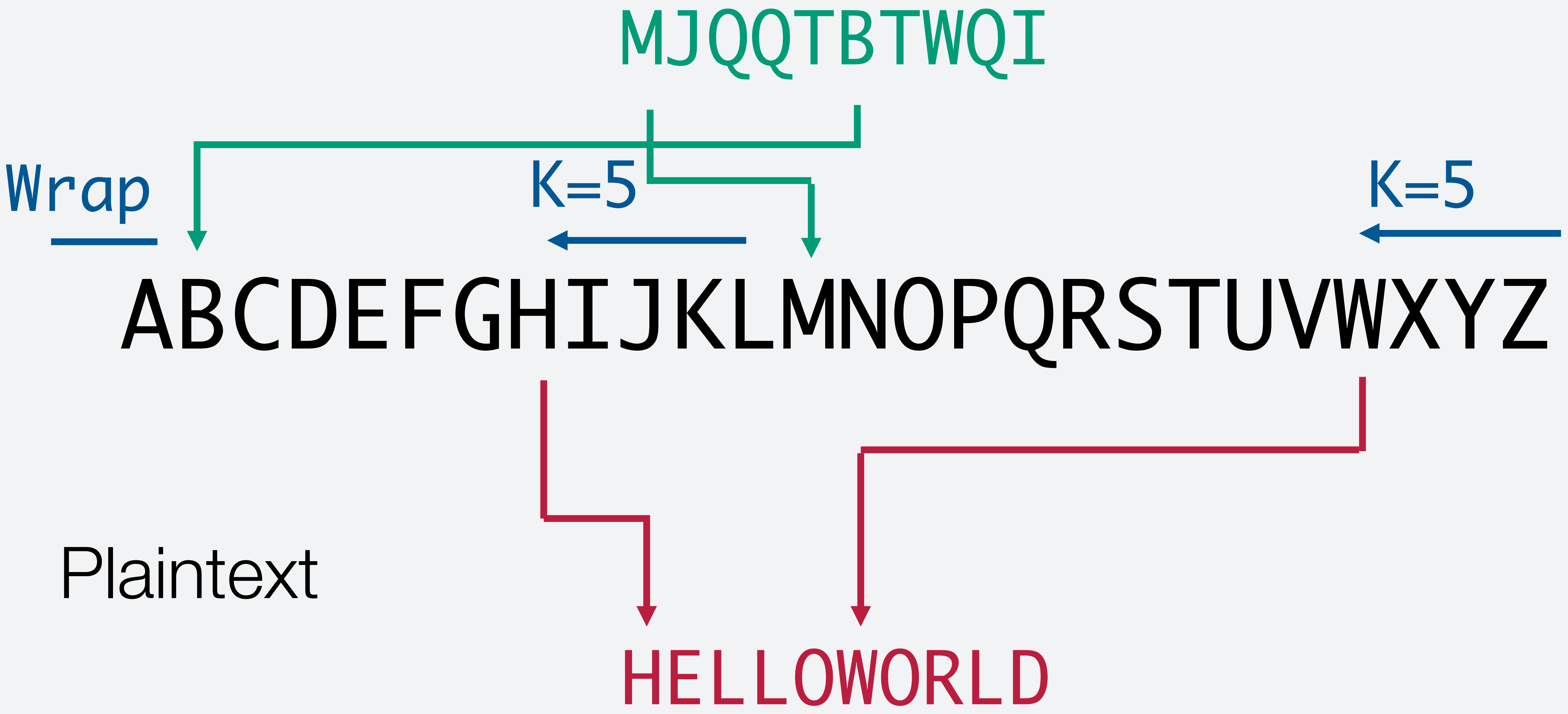
- If the shift goes beyond the start of the **Alphabet**, wrap around to ‘Z’ and continue counting **leftwards.**

- Shift *K* is an integer [0,25] and is the **Key** for the cipher

Decrypting With the Caesar Cipher, K=5

Ciphertext

Plaintext



C++ Implementation

- Many ways to implement the Caesar Cipher in C++
- Today we're going to create a function called `runCaesarCipher`
- Let's think about what the interface of our function should be:
  - What inputs are needed?
  - What will the output be?
  - Hence what arguments should it have? And what return type?
- What else is involved?

C++ Implementation

- Many ways to implement the Caesar Cipher in C++
- Today we're going to create a function called `runCaesarCipher`
- Let's think about what the interface of our function should be:
  - What inputs are needed? Input text, Key, Encrypt/Decrypt
  - What will the output be? Output text
  - Hence what arguments should it have? And what return type?

```
std::string runCaesarCipher( const std::string& inputText, const size_t key, const bool encrypt )
```

Could have used a reference argument for the output text but since C++11 there is little efficiency gain and the intention is clearer this way.

- What else is involved? The alphabet

C++ Implementation

```
std::string runCaesarCipher( const std::string& inputText,
                             const size_t key, const bool encrypt )
{
    // Create the alphabet container and output string

    // Loop over the input text

    // For each character find the corresponding position in the alphabet

    // Apply the shift (+ve or -ve depending on encrypt/decrypt)
    // to the position, handling correctly potential wrap-around

    // Determine the new character and add it to the output string

    // Finally (after the loop), return the output string
}
```

Exercise implementing the Caesar Cipher

1. Add handling of new command-line arguments that allow the user to:
   a) Specify whether to encrypt or decrypt
   b) Provide the cipher key
2. Implement the `runCaesarCipher` function (create new `.hpp` and `.cpp` files in the `MPAGSCipher` directory)
3. In your main function, use this function to encrypt/decrypt the transliterated text
4. You'll need to update the `CMakeLists.txt` file to build and link with this new code
5. When you have finished, commit and tag your repository (and push to github)

✓ There are some hints on the next slide to help with a few tricky points

Implementation hints

- You will need to convert a string into an unsigned long to get the key from the command line – look at the online documentation: http://en.cppreference.com/w/cpp/string/basic_string
- You can use either a `std::vector<char>` or a `std::string` to hold the alphabet
- To handle the “wrap-around”, the modulus operator '%' could be useful
- Test that you have things working correctly by running the decrypt on your encrypted output
  - There are also online javascript implementations that you can check against