

```
import numpy as np
```

```
# Function to convert text to numerical values (A=0, B=1, ..., Z=25)
```

```
def text_to_numbers(text):
```

```
    return [ord(char) - ord('A') for char in text.upper()]
```

```
# Function to convert numerical values back to text
```

```
def numbers_to_text(numbers):
```

```
    return "".join(chr(num + ord('A')) for num in numbers)
```

```
# Function to encrypt plaintext using Hill Cipher
```

```
def hill_encrypt(plaintext, key_matrix):
```

```
    # Convert plaintext to numbers
```

```
    text_vector = text_to_numbers(plaintext)
```

```
    # Reshape text vector to fit matrix multiplication
```

```
    text_vector = np.array(text_vector).reshape(-1, len(key_matrix))
```

```
    # Perform matrix multiplication and mod 26
```

```
    encrypted_vector = np.dot(text_vector, key_matrix) % 26
```

```
    # Convert numbers back to text
```

```
    encrypted_text = numbers_to_text(encrypted_vector.flatten())
```

```
    return encrypted_text
```

```
# Function to decrypt ciphertext using Hill Cipher
```

```
def hill_decrypt(ciphertext, key_matrix):
```

```
# Convert ciphertext to numbers
```

```
text_vector = text_to_numbers(ciphertext)
```

```
# Compute inverse of the key matrix modulo 26
```

```
det = int(round(np.linalg.det(key_matrix)))
```

```
det_inv = pow(det, -1, 26) # Modular inverse of determinant
```

```
# Adjugate matrix and mod 26
```

```
key_inv = np.round(det_inv * np.linalg.inv(key_matrix) * det).astype(int) % 26
```

```
# Reshape text vector to fit matrix multiplication
```

```
text_vector = np.array(text_vector).reshape(-1, len(key_matrix))
```

```
# Perform matrix multiplication and mod 26
```

```
decrypted_vector = np.dot(text_vector, key_inv) % 26
```

```
# Convert numbers back to text
```

```
decrypted_text = numbers_to_text(decrypted_vector.flatten())
```

```
return decrypted_text
```

```
# Example usage
```

```
key_matrix = np.array([[6, 24], [1, 13]]) # 2x2 key matrix
```

```
plaintext = "HI"
```

```
# Encrypting
```

```
ciphertext = hill_encrypt(plaintext, key_matrix)
```

```
print(f"Encrypted text: {ciphertext}")
```

```
# Decrypting
decrypted_text = hill_decrypt(ciphertext, key_matrix)
print(f"Decrypted text: {decrypted_text}")
```