Code:

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#include <iostream>
#include <string>
#include <algorithm>
using namespace std;

string encryptCaesar(string text, int shift) {
    string result = "";
    for (char c : text) {
        if (isalpha(c)) {
            char base = islower(c) ? 'a' : 'A';
            result += (c - base + shift) % 26 + base;
        } else {
            result += c;
        }
    }

    return result;
}
string decryptCaesar(string text, int shift) {
    return encryptCaesar(text, 26 - shift);
}

string transposeRows(string text, int rows, int cols) {
    string transposedText = "";

    for (int col = 0; col < cols; ++col) {
        for (int row = 0; row < rows; ++row) {
            transposedText += text[row * cols + col];
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        }
    }

    return transposedText;
}

string transposeColumns(string text, int rows, int cols) {
    string transposedText = "";

    for (int row = 0; row < rows; ++row) {
        for (int col = 0; col < cols; ++col) {
            transposedText += text[row + col * rows];
        }
    }

    return transposedText;
}

string transposeBoth(string text, int rows, int cols) {
    string transposedText = transposeRows(text, rows, cols);
    return transposeColumns(transposedText, cols, rows);
}

int power(int base, int exp, int mod) {
    if (exp == 0) return 1;
    long long temp = power(base, exp / 2, mod);
    long long result = (temp * temp) % mod;
    if (exp % 2 == 1) result = (result * base) % mod;
    return static_cast<int>((result + mod) % mod);
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}

int diffieHellman(int base, int prime) {
    int privateA, privateB;
    cout << "Enter Alice's private key: ";
    cin >> privateA;
    cout << "Enter Bob's private key: ";
    cin >> privateB;

    int publicA = power(base, privateA, prime);
    int publicB = power(base, privateB, prime);

    int secretKeyA = power(publicB, privateA, prime);
    int secretKeyB = power(publicA, privateB, prime);

    if (secretKeyA == secretKeyB) {
        cout << "Shared Secret Key: " << secretKeyA << endl;
        return secretKeyA;
    } else {
        cout << "Error in key exchange!" << endl;
        return -1;
    }
}

string encryptVigenere(string plaintext, string keyword) {
    string ciphertext = "";
    int keyLength = keyword.length();
    int textLength = plaintext.length();
    char encryptedChar;
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    for (int i = 0; i < textLength; ++i) {
        char plainChar = plaintext[i];
        char keyChar = keyword[i % keyLength];

        if (isalpha(plainChar)) {
            plainChar = toupper(plainChar);
            keyChar = toupper(keyChar);

            encryptedChar = 'A' + ((plainChar - 'A' + keyChar - 'A') % 26);
        } else {
            encryptedChar = plainChar;
        }

        ciphertext += encryptedChar;
    }

    return ciphertext;
}

void encryptionMenu() {
    int choice;
    string text, keyword;
    int shift, base, prime;

    while (true) {
        cout << "Choose encryption method:\n";
        cout << "1. Caesar Cipher\n";
        cout << "2. Transpose Cipher\n";
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cout << "3. Diffie-Hellman Key Exchange\n";
cout << "4. Polyalphabetic Cipher\n";
cout << "5. Exit\n";
cout << "Enter your choice: ";
cin >> choice;
cin.ignore();

switch (choice) {
   case 1:
      cout << "Enter the text to encrypt/decrypt: ";
      getline(cin, text);

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

      text = encryptCaesar(text, shift);
      cout << "Processed text: " << text << endl;
      break;

   case 2:
      cout << "Enter the text to transpose: ";
      getline(cin, text);

      int transposeChoice;
      int rows, cols;

      cout << "Choose transpose method:\n";
      cout << "1. Transpose with Rows\n";
      cout << "2. Transpose with Columns\n";
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cout << "3. Transpose with Both Rows and Columns\n";
cout << "Enter your choice: ";
cin >> transposeChoice;
cin.ignore();

switch (transposeChoice) {
   case 1:
      cout << "Enter the number of rows: ";
      cin >> rows;
      cout << "Enter the number of columns: ";
      cin >> cols;
      text = transposeRows(text, rows, cols);
      cout << "Transposed text with rows: " << text << endl;
      break;

   case 2:
      cout << "Enter the number of rows: ";
      cin >> rows;
      cout << "Enter the number of columns: ";
      cin >> cols;
      text = transposeColumns(text, rows, cols);
      cout << "Transposed text with columns: " << text << endl;
      break;

   case 3:
      cout << "Enter the number of rows: ";
      cin >> rows;
      cout << "Enter the number of columns: ";
      cin >> cols;
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            text = transposeBoth(text, rows, cols);
            cout << "Transposed text with both rows and columns: " << text << endl;
            break;

        default:
            cout << "Invalid choice. Please enter a valid option.\n";
    }
    break;

case 3:
    cout << "Enter a prime number (modulus): ";
    cin >> prime;
    cout << "Enter a primitive root modulo " << prime << ": ";
    cin >> base;
    diffieHellman(base, prime);
    break;

case 4:
    cout << "Enter the text to encrypt: ";
    cin.ignore();
    getline(cin, text);
    cout << "Enter the keyword: ";
    getline(cin, keyword);
    text = encryptVigenere(text, keyword);
    cout << "Encrypted Text: " << text << endl;
    break;

case 5:
    cout << "Exiting the program.\n";
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            return;

        default:
            cout << "Invalid choice. Please enter a valid option.\n";
      }
   }
}

int main() {
   encryptionMenu();

   return 0;
}
```

Output:

Choose encryption method:

1. Caesar Cipher

2. Transpose Cipher

3. Diffie-Hellman Key Exchange

4. Polyalphabetic Cipher

5. Exit

Enter your choice: 1

Enter the text to encrypt/decrypt: Tanay

Enter the shift value: 1

Processed text: Ubobz

Choose encryption method:

1. Caesar Cipher

2. Transpose Cipher

3. Diffie-Hellman Key Exchange

4. Polyalphabetic Cipher

5. Exit

Enter your choice: 2

Enter the text to transpose: Tanay

Choose transpose method:

1. Transpose with Rows

2. Transpose with Columns

3. Transpose with Both Rows and Columns

Enter your choice: 3

Enter the number of rows: 1

Enter the number of columns: 2

Transposed text with both rows and columns: Ta

Choose encryption method:

1. Caesar Cipher

2. Transpose Cipher

3. Diffie-Hellman Key Exchange

4. Polyalphabetic Cipher

5. Exit

Enter your choice: 3

Enter a prime number (modulus): 3

Enter a primitive root modulo 3: 17

Enter Alice's private key: 6

Enter Bob's private key: 15

Shared Secret Key: 1

Choose encryption method:

1. Caesar Cipher

2. Transpose Cipher

3. Diffie-Hellman Key Exchange

4. Polyalphabetic Cipher

5. Exit

Enter your choice: 4

Enter the text to encrypt: Tanay

Enter the keyword: Hi

Encrypted Text: HVHG

Choose encryption method:

1. Caesar Cipher

2. Transpose Cipher

3. Diffie-Hellman Key Exchange

4. Polyalphabetic Cipher

5. Exit

Enter your choice: 5

Exiting the program.

Explaination:

- **Caesar Cipher (encryptCaesar and decryptCaesar functions):** Performs encryption and decryption using a shift-based substitution technique. It shifts each letter of the input text by a fixed number of positions in the alphabet.
- **Transpose Cipher (transposeRows, transposeColumns, transposeBoth functions):** Provides options to transpose the input text either by rows, columns, or both. It rearranges the characters in the input text based on the specified number of rows and columns.
- **Diffie-Hellman Key Exchange (diffieHellman function):** Implements the Diffie-Hellman key exchange algorithm, enabling two parties (Alice and Bob) to securely establish a shared secret key over an insecure channel using modular arithmetic.
- **Polyalphabetic Cipher (encryptVigenere function)**: Implements the Polyalphabetic substitution cipher that encrypts text using a keyword. It shifts each character of the input text by the corresponding character in the keyword