CIS 3362 Quiz #1: Shift, Affine, GCD, Substitution, Vigenere

Date: 9/3/2025

Name : _____

1) (5 pts) Encrypt the plaintext “THIRD” using the shift cipher with a key equal to 15.

____ ____ ____ ____ ____

2) (6 pts) The encryption keys for an Affine Cipher with alphabet size 26 are a = 11, b = 13. What are the corresponding decryption keys? (Credit given for work but formula sheet should be used appropriately.

a = _____ , b = _____

3) (12 pts) Determine 107^{-1} mod 243. Show your work and give a final answer in between 0 and 242, inclusive.

4) (10 pts) A substitution cipher can be stored in a character array of size 26, where code[i] stores the cipher text letter corresponding to the i^{th} letter of the alphabet with i ranging from 0 to 25. For example, if code started "TQEB...", then the plaintext letter 'A' would map to the ciphertext letter 'T', the plaintext letter 'B' would map to the ciphertext letter 'Q', etc. To decrypt a ciphertext made with this substitution, we would want to store the inverse substitution. In the example above, for the inverse substitution, inverse[1] = 'D' because the ciphertext letter 'B' maps to the plaintext letter D. Complete the function below, so that it takes in a string of length 26 storing a substitution code and returns another string of length 26 storing the corresponding inverse substitution code. Some of the code has been provided (mostly the annoying dynamic memory and NULL char code). **Assume that code stores 26 unique uppercase letters. The string your function returns should also store 26 unique uppercase letters. Note: Code is short for this one.**

```
char* getInverse(char* code) {

    char* inverse = calloc(27, sizeof(char));
    inverse[26] = '\0';









    return inverse;
}
```

5) (10 pts) The ciphertext "MIHOILYYFH" was encrypted with the Vigenere Cipher with the secret key, "HOUSE". What is the plaintext?

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

6) (6 pts) A set of letters contains 20 As, 10 Bs, 10 Cs and 10 Ds. What is the index of coincidence for this set of letters? Express your answer as a **fraction in lowest terms.**

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7) (1 pt) The United States Open, a major tennis tournament is set to conclude this Sunday. In what country does this tournament take place?

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