

**CIS 3362 Homework #2A: Substitution Cipher, Vigenere**  
**Due: Check WebCourses for the due date. (Will be before Quiz #1)**

Part A: Written Questions Similar to Quiz/Exam Questions

- 1) Find  $183^{-1} \bmod 251$ .
- 2) For an affine cipher, we know that the ciphertext 'X' maps to the plaintext 'X' and the ciphertext 'W' maps to the plaintext 'E'. Determine both the decryption AND encryption functions. Both answers must be in the form  $f(x) = (ax + b) \bmod 26$ , where a and b are in between 0 and 25, inclusive.
- 3) For an alphabet of size 96, how many possible keys would there be to the affine cipher? (Hint: Use logic and the inclusion-exclusion principle to more quickly determine the possible values of a, instead of listing them out one by one!)
- 4) Let x be a positive integer. A set of letters consists of 50 As, 25 Bs, 5 Cs, 45 Ds, and 75 Es. What is the index of coincidence of the set? **Leave your answer as a fraction in lowest terms.**
- 5) The set of letters S consists of 5 As, 15 Bs, 25 Cs, 30 Ds, and 25 Es. The set of letters T consists of 30 As, 26 Bs, 4 Cs, 16 Ds and 24 Es. What is the mutual index of coincidence between sets S and T? **Leave your answer as a fraction in lowest terms.**

**NOTE: Homework 2B, including the codebreaking, will be posted on Thursday, August 31, 2023 and will have a later due date than Homework 2A.**