CSS 322 – QUIZ 2 ANSWERS

First name: _____ Last name: _____

ID: _____ Total Marks: _____

out of 10

Question 1 [2 marks]

Confusion is a fundamental concept in block ciphers: *confusion* aims to make the relationship between the ciphertext and key as complex as possible, usually using a complex substitution algorithm. In DES, select the component that provides the most *confusion* (only select one):

1. Initial Permutation
2. **S-Boxes**
3. Expand and Permutation operation
4. Permutation of S-box outputs
5. Swapping the left and right halves
6. Exclusive OR operations

Question 2 [2 marks]

Indicate whether each statement is True or False (circle the correct answer):

a) A desirable property of an encryption algorithm is that small changes in key values produces small changes in the output ciphertext T / **F**

b) DES is no longer recommended for use because the Feistel structure does not provide adequate security. T / **F**

c) AES can use a smaller block size than DES. T / **F**

d) 16 subkeys are generated for DES encryption – we must generate another 16 different subkeys for the corresponding DES decryption operation. T / **F**

Question 3 [2.5 marks]

Connect the operations on the left with the correct description on the right for Simplified AES:

a. The Shift Row operation	1. uses an exclusive OR with a 8-bit constant (10000000)
b. The Add Key operation	2. uses S-Boxes.
c. The Mix column operation	3. swaps the 2^{nd} and 4^{th} nibbles in the state matrix.
d. Nibble substitution	4. uses an exclusive OR on a round key.
e. Key generation	5. uses Galois Field GF(2^4) arithmetic.

a – 3; b – 4; c – 5; d – 2; e – 1 or 2

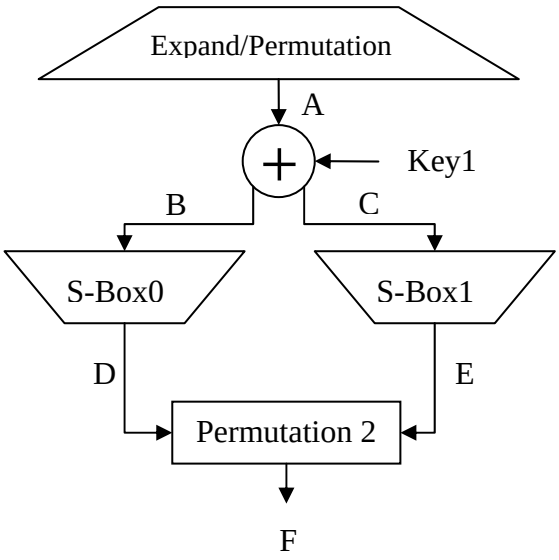
Question 4 [3.5 marks]

Calculate the values for B, C, D, E and F in the diagram for S-DES encryption below, where A = 11011000 and Key 1 = 01010000. You may use the information below the diagram.

Answer (B): __1000_____ Answer (C): _1000_____

Answer (D): __00_____ Answer (E): __11_____

Answer (F): __0110_____



Expand/Permutation with 8 bit input, output bit order is: 4 1 2 3 2 3 4 1

Permutation 2, output bit order is: 2 4 3 1

S-Box 0

$$S0 = \begin{bmatrix} 01 & 00 & 11 & 10 \\ 11 & 10 & 01 & 00 \\ 00 & 10 & 01 & 11 \\ 11 & 01 & 11 & 10 \end{bmatrix}$$

S-Box 1

$$S1 = \begin{bmatrix} 00 & 01 & 10 & 11 \\ 10 & 00 & 01 & 11 \\ 11 & 00 & 01 & 00 \\ 10 & 01 & 00 & 11 \end{bmatrix}$$