CSS 322 – QUIZ 2

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 2nd and 4th nibbles in the state matrix.

d. Nibble substitution   4. uses an exclusive OR on a round key.

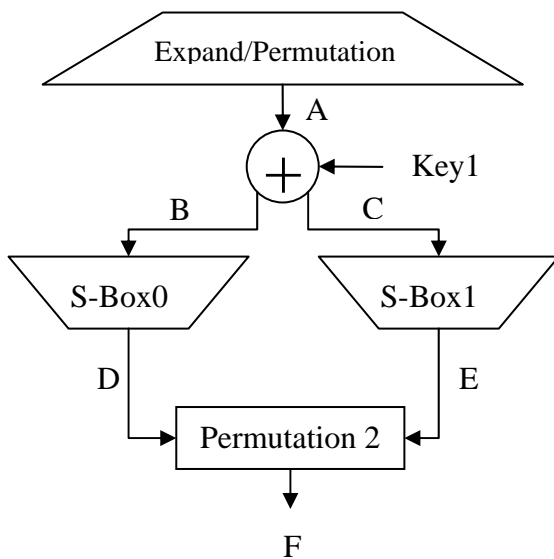e. Key generation   5. uses Galois Field $GF(2^4)$ arithmetic.

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): _____   Answer (C): _____

Answer (D): _____   Answer (E): _____

Answer (F): _____

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   S-Box 1

$$S0 = \begin{bmatrix} 01 & 00 & 11 & 10 \\ 11 & 10 & 01 & 00 \\ 00 & 10 & 01 & 11 \\ 11 & 01 & 11 & 10 \end{bmatrix} \qquad S1 = \begin{bmatrix} 00 & 01 & 10 & 11 \\ 10 & 00 & 01 & 11 \\ 11 & 00 & 01 & 00 \\ 10 & 01 & 00 & 11 \end{bmatrix}$$