CS4823/5823 HOMEWORK ON Symmetric Key Encryption

1. 3.16.2
2. 3.16.6
3. Suppose that we use Caesar cipher with multiplication over Z/26Z (i.e. affine cipher):
$$c = 11p + 5.$$
What is the ciphertext for "TEXAS"? What is the plaintext for "OKLAHOMA" if we treat it as ciphertext?
4. Explain why in the AES S-box, the hexadecimal number `93` is substituted by `dc`. Please show step-by-step calculations.
5. Suppose that a Hill cipher with alphabet $\{0, 1\}$ and block length 3 is used to encrypt messages. And suppose that we discover three plaintext-ciphtertext pairs:
$$(100) \to (101), (110) \to (110), (111) \to (001).$$
Recover the encryption key.
6. Suppose that a Vigenere cipher with alphabet A-Z (0-25) and block length 5 is used to encrypt a word and the ciphertext is MTYGH. If the plaintext is ALICE, what is the encryption key? If the plaintext is TEXAS, what is the encryption key?