

# Computer Security Assignment 2

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## 1 Expression for Encryption and Decryption Modes

### 1.1 Expression for Encryption and Decryption Modes in CFB mode

CFB mode is the Cipher FeedBack mode.

#### Expression for CFB mode encryption of a stream cipher

$$\begin{aligned}I_i &= LSB(IV_{i-1} || C_{i-1}) \\X_i &= E(K, I_i) \\C_i &= m_i \oplus S_r(X_i) \\C_i &= m_i \oplus S_r(E(K, I_i)) \\C_i &= m_i \oplus S_r(E(K, LSB(IV_{i-1} || C_{i-1})))\end{aligned}$$

The above are the equations for CFB encryption mode. The following are the definitions for the symbols

LSB - Least Significant Bit  
IV - Initialization Vector  
C - Cipher Text  
m - Message  
 $E(K, I_i)$  - Initialization Vector is encrypted with Key K.  
 $S_r(X_i)$  - Most Significant r bits of  $X_i$

#### Expression for CFB mode decryption of a stream cipher

$$\begin{aligned}I_i &= LSB(IV_{i-1} || P_{i-1}) \\X_i &= E(K, I_i) \\P_i &= C_i \oplus S_r(X_i) \\P_i &= C_i \oplus S_r(E(K, I_i)) \\P_i &= C_i \oplus S_r(E(K, LSB(IV_{i-1} || P_{i-1})))\end{aligned}$$

The above are the equations for CFB encryption mode. The following are the definitions for the symbols

LSB - Least Significant Bit  
IV - Initialization Vector  
C - Cipher Text  
 $P_i$  - Plain Text  
 $E(K, I_i)$  - Initialization Vector is encrypted with Key K.  
 $S_r(X_i)$  - Most Significant r bits of  $X_i$

## 1.2 Expression for Encryption and Decryption Modes in OFB mode

OFB mode is the Output FeedBack mode.

### Expression for OFB mode encryption of a stream cipher

$I_i = LSB(IV_{i-1} || S_r(X_{i-1}))$   
 $X_i = E(K, I_i)$   
 $C_i = m_i \oplus S_r(X_i)$   
 $C_i = m_i \oplus S_r(E(K, I_i))$   
 $C_i = m_i \oplus S_r(E(K, LSB(IV_{i-1} || S_r(X_{i-1}))))$

The above are the equations for OFB encryption mode. The following are the definitions for the symbols

LSB - Least Significant Bit  
IV - Initialization Vector  
C - Cipher Text  
m - Message  
 $E(K, I_i)$  - Initialization Vector is encrypted with Key K.  
 $S_r(X_i)$  - Most Significant r bits of  $X_i$

### Expression for OFB mode decryption of a stream cipher

$I_i = LSB(IV_{i-1} || S_r(X_{i-1}))$   
 $X_i = E(K, I_i)$   
 $P_i = C_i \oplus S_r(X_i)$   
 $P_i = C_i \oplus S_r(E(K, I_i))$   
 $P_i = C_i \oplus S_r(E(K, LSB(IV_{i-1} || S_r(X_{i-1}))))$