Data Encryption Standard (DES)

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DES

The Data Encryption Standard (DES) is a symmetric-key block cipher published by the National Institute of Standards and Technology (NIST).

In 1973, NIST published a request for proposals for a national symmetric-key cryptosystem. A proposal from IBM, a modification of a project called Lucifer, was accepted as DES. DES was published in the Federal Register in March 1975 as a draft of the Federal Information Processing Standard (FIPS).

DES

Message M=11011001   IP : 2 6 3 1 4 8 5 7
k1: 10100010

1- initial Permutation (IP)

2   6 3 1 4 8 5 7
1   00 1 1 1 1 0

Mp= 100111110

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2- Divide Msg into L,R

L0 = 1001, R0=1110

DES

Message M=11011001
k1: 10100010

3- Find L1,R1

L1=R0 → L1=1110

R1=f(L0 xor f(R0,K1) xor R0)

F(R0,K1)=E(R0) xor k1 → 01111101 xor 10100010

F(R0,K1)=11011111 using S-Box →1111

R1=f(1001 xor 1111 xor 1110) → f(0110 xor 1110)

R1→ 1000

Expansion Array: 4 1 2 3 2 3 4 1

E(R0)   :0 1 1 1 1 1 0 1

DES

Message M=11011001
k1: 10100010

inv(IP) : inv(2 6 3 1 4 8 5 7)
: 4 1 3 5 7 2 8 6

4- Concatenate R1+L1

M= 10001110

5- Final Permutation

4 1 3 5 7 2 8 6
0 1 0 1 1 0 0 1

Msg :01011001

DES

Message M=11011001   inv(IP) : inv(2 6 3   1 4 8 5   7)
k1: 10100010   :   4 1 3   5 7 2 8 6

4- Concatenate R1+L1   11011001

  M= 10001110

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                                     k1: 10100010

                                                          CIPHER(DES)

5- Final Permutation
  4 1 3 5 7 2 8 6
  0 1 0 1 1 0 0 1
                                                                   01011001
Msg :01011001