M = 10011010

$K_1 = \{11101001\}$

$K_2 = \{10100111\}$

Apply initial permutation on Plaintext (M)

Plain text = 10011010

IP	2	6	3	1	4	8	5	7

Bit #	1	2	3	4	5	6	7	8
P	1	0	0	1	1	0	1	0
IP(P)	0	0	0	1	1	0	1	1

Now divide it two half

Left half = 0001

Right half = 1011

EIP
4 1 2 3 2 3 4 1

Steps

Bits	1	2	3	4	5	6	7	8
R	1	0	1	1				
E/P(R)	1	1	0	1	0	1	1	1
K 1	1	1	1	0	1	0	0	1
E/P(R) ⊕ K1	0	0	1	1	1	1	1	0

S Boxes(EIP(R) ⊕ k1) 1 0 0 0

P4(S Boxes(EIP(R) ⊕ k1) 0 0 0 1

Rearrange P4

P4	2	4	3	1

$$
\begin{array}{c|cccc}
 & 0 & 1 & 2 & 3 \\
\hline
S_0 = 0 & 1 & 0 & 3 & 2 \\
1 & 3 & 2 & 1 & 0 \\
2 & 0 & 2 & 1 & 3 \\
3 & 3 & 1 & 3 & 2
\end{array}
$$

0	0	1	1

Row = 01 = 2

Col 01 = 1

$$
\begin{array}{c|cccc}
 & 0 & 1 & 2 & 3 \\
\hline
S_1 = 0 & 0 & 1 & 2 & 3 \\
1 & 2 & 0 & 1 & 3 \\
2 & 3 & 0 & 1 & 0 \\
3 & 2 & 1 & 0 & 3
\end{array}
$$

1	1	1	0

row 10 = 2

col 11 = 3

0

Now

Calculate f(k1)(L, R)

= (0001 ⊕ 0001, 1011)

= (0000, 1011)

Now we apply swap function

L = 0000

R = 0000

After swapping value

L = 1011

R = 0000

Use K2 = 10100111

Again apply initial permutation on plaintext

Bits	1	2	3	4	5	6	7	8
P	1	0	0	1	1	0	1	0
IP(P)	0	0	0	1	1	0	1	1

After swapping left or right value:

Right = 0000

Left = 1011

Steps $\boxed{EP \mid 4 \mid 1 \mid 2 \mid 3 \mid 2 \mid 3 \mid 4 \mid 1}$

Bits	1	2	3	4	5	6	7	8
R	0	0	0	0	0	0	1	0
E/P(R)	1	0	0	0	0	1	1	1
K_2	1	0	1	0	0	1	1	1
E/P(R) ⊕ K_2	1	0	1					

Left value in S Box.

001010

$$\left.\begin{array}{l} \text{Row} = \cancel{0}10 = 2 \\ \text{Col} = 01 = 1 \end{array}\right\} 2 \text{ (two bit value is 00)}$$

Right value in S Box 1

0101

$$\left.\begin{array}{l} \text{row} = 01 = 1 \\ \text{col} = 11\cancel{0} = 3 \end{array}\right\} = 3 \text{ (two bit value is 01)}$$

	1	2	3	4
$SBox(E/P(R) \oplus k_2)$	$\cancel{0}1$	0	$1\cancel{0}$	1

Apply P_4

P_4	2	4	3	1

$P_4(SBox(E/P(R) \oplus k_2))$	0	1	$1\cancel{0}$	$\cancel{0}1$

Scanned by CamScanner

→ Now calculate $f_{(k_2)}(L, R)$

$(1011 \oplus 0111, 0000)$

$1100, 0000$

→ Now we apply the IP^{-1}

IP^{-1} | 4 | 1 | 3 | 5 | 7 | 2 | 8 | 6 |

Bit	1	2	3	4	5	6	7	8
R.L	1	1	0	0	0	0	0	0
IP^{-1}(R.L)	0	1	0	0	0	1	0	0

→ The encryption text is

Plaintext = 10011010

E (text) = 01000100