

$0000 \rightarrow 1000 \rightarrow 1100 \rightarrow 1110 \rightarrow 1111 \rightarrow 0111 \rightarrow 0011 \rightarrow 0001$
 \uparrow

	Q_3	Q_2	Q_1	Q_0	Q_3^+	Q_2^+	Q_1^+	Q_0^+	J_3	K_3	J_2	K_2	J_1	K_1	J_0	K_0
0	0	0	0	0	1	0	0	0	1	-	0	-	0	-	0	-
8	1	0	0	0	1	1	0	0	-	0	1	-	0	-	0	-
12	1	1	0	0	1	1	1	0	-	0	-	0	1	-	0	-
14	1	1	1	0	1	1	1	1	-	0	-	0	-	0	1	-
15	1	1	1	1	0	1	1	1	-	1	-	0	-	0	-	0
7	0	1	1	1	0	0	0	0	1	0	-	1	-	0	-	0
3	0	0	0	1	0	0	0	0	0	1	-	0	-	0	-	0
1	0	0	0	0	0	0	0	0	0	1	-	0	-	0	-	1

Now K-map for:

$J_0 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
$Q_3 Q_2$	00	0	-	-	-
$Q_3 Q_2$	01	1	-	-	-
$Q_3 Q_2$	11	0	-	-	1
$Q_3 Q_2$	10	0	-	-	-

$$J_0 = Q_1$$

$J_1 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
$Q_3 Q_2$	00	0	0	-	-
$Q_3 Q_2$	01	-	-	-	-
$Q_3 Q_2$	11	1	-	-	-
$Q_3 Q_2$	10	0	-	-	-

$$J_1 = Q_2$$

$K_0 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
$Q_3 Q_2$	00	-	1	0	-
$Q_3 Q_2$	01	-	-	0	-
$Q_3 Q_2$	11	-	-	0	-
$Q_3 Q_2$	10	-	-	-	-

$$K_0 = \overline{Q_1}$$

$K_1 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
$Q_3 Q_2$	00	-	-	1	-
$Q_3 Q_2$	01	-	-	0	-
$Q_3 Q_2$	11	-	-	0	0
$Q_3 Q_2$	10	-	-	-	-

$$K_1 = \overline{Q_2}$$

$J_2 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
00		0	0	0	-
01		-	-	-	-
11		-	-	-	-
10		1	-	-	-

$J_2 = Q_3$

$K_2 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
00		-	-	-	-
01		-	-	1	-
11		0	-	0	0
10		-	-	-	-

$K_2 = \overline{Q_3}$

$J_3 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
00		1	0	0	-
01		-	-	0	-
11		-	-	1	-
10		-	-	-	-

$J_3 = \overline{Q_0}$

$K_3 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
00		-	-	-	-
01		-	-	-	-
11		0	-	1	0
10		0	-	-	-

$K_3 = Q_0$

$J_4 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
00		1	0	0	-
01		-	-	0	-
11		-	-	1	-
10		-	-	-	-

$J_4 = 1$

$K_4 \Rightarrow$

$Q_3 Q_2$	$Q_1 Q_0$	00	01	11	10
00		-	-	-	-
01		-	-	-	-
11		0	-	1	0
10		0	-	-	-

$K_4 = 1$

$0000 \rightarrow 0$
 $1000 \rightarrow 8$
 $1100 \rightarrow 12$
 $1110 \rightarrow 14$
 $1111 \rightarrow 15$
 $0111 \rightarrow 7$
 $0011 \rightarrow 3$
 $0001 \rightarrow 1$
 $0000 \rightarrow 0$

Excitation Table

$Q_i(t)$	$Q_i(t+1)$	i	j
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

Present state

Q_3	Q_2	Q_1	Q_0
0	0	0	0
1	0	0	1
0	0	1	0
3	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
7	1	1	1
8	0	0	0
9	0	0	1
10	0	1	0
11	0	1	1
12	1	0	0
13	1	0	1
14	1	1	0
15	1	1	1

Next state

Q_3	Q_2	Q_1	Q_0	J_A	K_A	J_B	K_B	J_C	K_C	J_D	K_D
0	0	0	0	1	X	0	X	0	X	0	X
1	0	0	0	0	X	0	X	0	X	X	1
X	X	X	X	X	X	X	X	X	X	X	X
0	0	0	1	0	X	0	X	X	1	X	0
X	X	X	X	X	X	X	X	X	X	X	X
0	0	1	0	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X
0	0	1	1	0	X	X	X	X	0	X	0
1	1	0	0	X	0	X	X	0	X	0	X
X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X
0	0	1	1	0	X	X	X	X	0	X	0
1	1	0	0	X	0	X	X	0	X	0	X
X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X
0	0	1	1	0	X	X	X	X	0	X	0
1	1	0	0	X	0	X	X	0	X	0	X
X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X

$$\begin{aligned}
 J_0 &= \sum m(0) + d(2, 4, 5, 6, 7, 10, 11, 13, 8, 12, 14, 15) \\
 K_0 &= \sum m(15) + d(2, 4, 5, 6, 7, 10, 11, 13, 0, 1, 3, 7) \\
 J_1 &= \sum m(8) + d(2, 4, 5, 6, 9, 10, 11, 13, 12, 14, 15) \\
 K_1 &= \sum m(7) + d(2, 4, 5, 6, 9, 10, 11, 13, 0, 1, 3, 7) \\
 J_2 &= \sum m(12) + d(2, 4, 5, 6, 9, 10, 11, 13, 3, 7, 14, 15) \\
 K_2 &= \sum m(3) + d(2, 4, 5, 6, 9, 10, 11, 13, 0, 1, 8, 12) \\
 J_3 &= \sum m(14) + d(2, 4, 5, 6, 9, 10, 11, 13, 13, 7, 15) \\
 K_3 &= \sum m(1) + d(2, 4, 5, 6, 9, 10, 11, 13, 0, 8, 12, 14, 15)
 \end{aligned}$$

J_0

$\phi_2 \phi_3$	00	01	11	10
$\phi_0 \phi_1$	1	0	0	x
00				
01	x	x	0	x
11	x	x	x	x
10	x	x	x	x

$J_0 = \overline{0}_3$

K_0

$\phi_2 \phi_3$	00	01	11	10
$\phi_0 \phi_1$	x	x	x	x
00				
01	x	x	x	x
11		x	1	
10	x	x	x	x

$K_0 = 0_3$

J_1

$\phi_2 \phi_3$	00	01	11	10
$\phi_0 \phi_1$				x
00				
01	x	x	x	x
11	x	x	x	x
10	1	x	x	x

$J_1 = 0_0$

K_1

$\phi_2 \phi_3$	00	01	11	10
$\phi_0 \phi_1$	x	x	x	x
00				
01	x	x	1	x
11		x		
10	x	x	x	x

$K_1 = \overline{0}_0$

J_2

$\phi_2 \phi_3$	00	01	11	10
$\phi_0 \phi_1$			x	x
00				
01	x	x	x	x
11	1	x	x	x
10		x	x	x

$J_2 = 0_1$

K_2

$\phi_2 \phi_3$	00	01	11	10
$\phi_0 \phi_1$	x	x	1	x
00				
01	x	x		x
11	x	x		
10	x	x	x	x

$K_2 = \overline{0}_1$

J_3

$Q_0 Q_1 \backslash Q_2 Q_3$	00	01	11	TD
00		X	X	X
01	X	X	X	X
11		X	X	①
10		X	X	X

$$J_3 = 0$$

K_3

$Q_0 Q_1 \backslash Q_2 Q_3$	00	01	11	10
00	X	①		X
01	X	X		X
11	X	X	X	X
10	X	X	X	X

$$K_3 = \overline{Q_2}$$

$J_0 = \overline{Q_3}$ $K_0 = Q_3$	$J_1 = Q_0$ $K_1 = \overline{Q_0}$	$J_2 = Q_1$ $K_2 = \overline{Q_1}$	$J_3 = Q_2$ $K_3 = \overline{Q_2}$
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