DIGITAL : CLOCK

BY
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TEAM MEMBERS

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POWER

ZIAD ESSAM
COMMUNICATION

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COMMUNICATION

YAHIA RAMADAN
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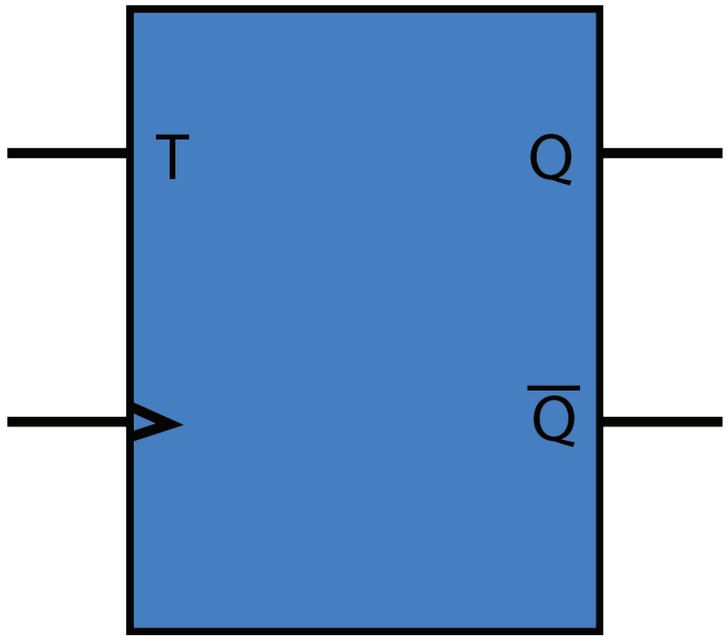
GENERAL IDEA

MANUFACTURING A DIGITAL CLOCK USING A FLIP FLOP T-TYPE



STEPS

SECONDS “ONES”

MINUTES “TENS“

HOURS “ONES”

0:00

SECONDS “TENS“

MINUTES “ONES”

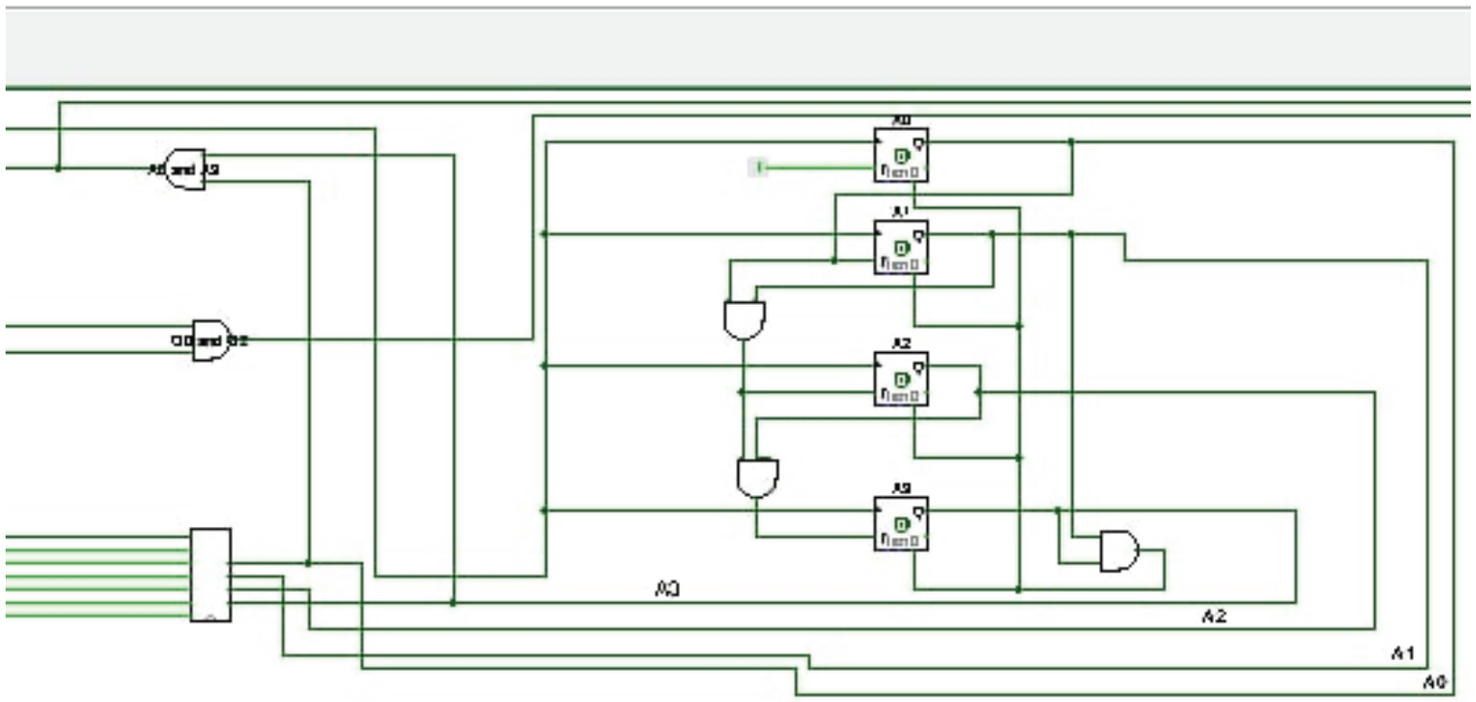
HOURS “TENS“

AM&PM

SECONDS “ONES”

MANUFACTURING 4 FLIP FLOP T-TYPE

$$To_{stage} = To_{stage\ before} * OUT_{stage\ before}$$



THEY HAVE 4 INPUTS:

To T1 T2 T3

AND HAVE 4 OUTPUTS:

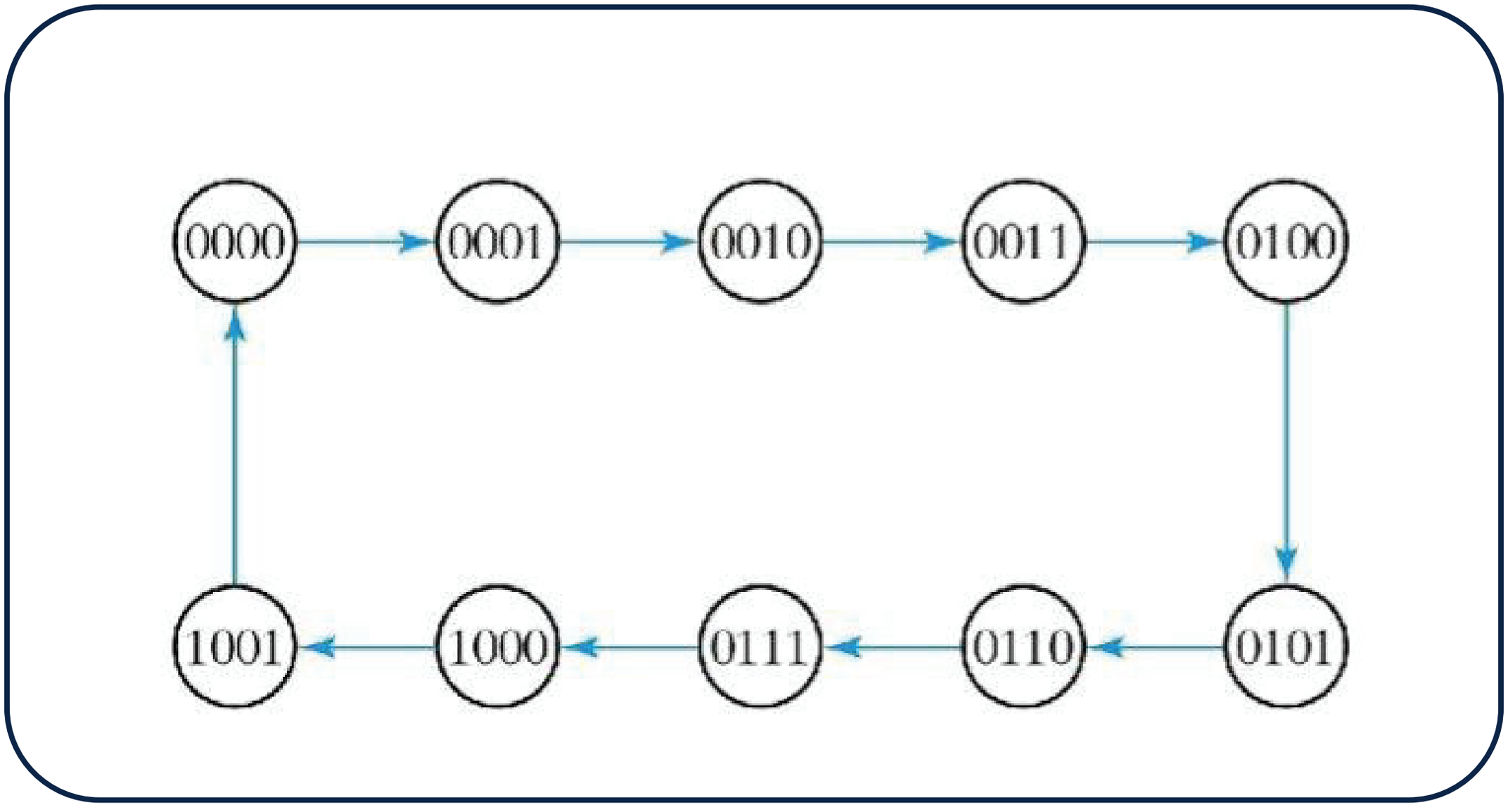
Ao A1 A2 A3

AS:

To = 1
T1 = Ao “To”
T2 = Ao A1 “To”
T3 = Ao A1 A2 “To”

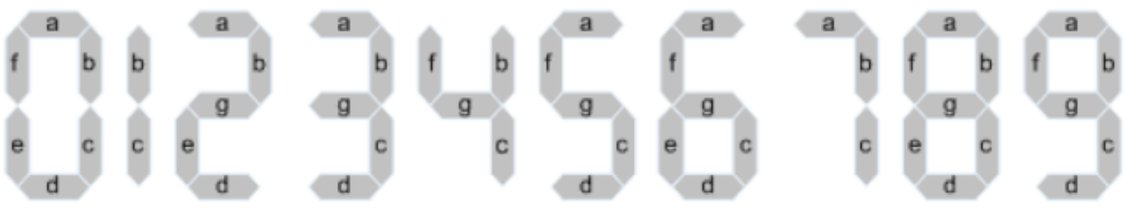
DO A RESET FROM NUMBER 10 THROUGH CONNECTING THE AND OUTPUT A1 AND A3 TOGETHER USING AND GATE.

STATE DIAGRAM

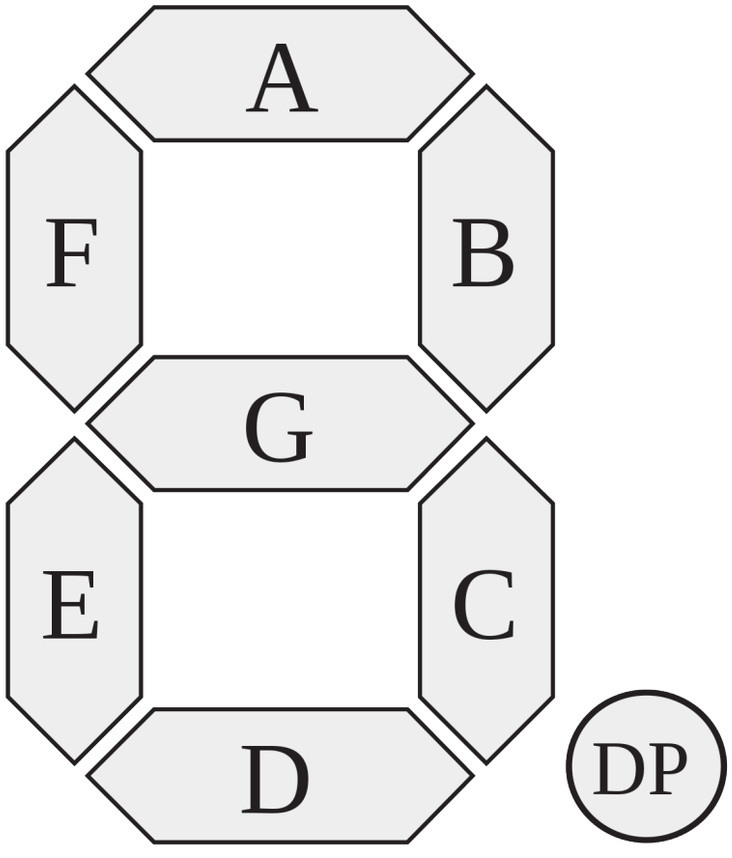


7 SEGMENT

USING THE OUTPUTS OF THE BUILDBOX TO GET THE BOOLEAN FUNCTIONS OF EACH SEGMENTS OF THE 7 SEGMENT. SO IN ORDER TO DISPLAY THE NUMBER “3” FOR EXAMPLE, SEGMENTS A, B, C, D AND G WOULD NEED TO BE ILLUMINATED. IF WE WANTED TO DISPLAY A DIFFERENT NUMBER OR LETTER THEN A DIFFERENT SET OF SEGMENTS WOULD NEED TO BE ILLUMINATED.



7-Segment Display Elements for all Numbers.



7 SEGMANT K-MAPS

Output: A

Format: Sum of products

A3, A2 \ A1, A0	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x

$\overline{A2}\,\overline{A0} + A1 + A2\,A0 + A3$

Output: B

Format: Sum of products

A3, A2 \ A1, A0	00	01	11	10
00	1	1	1	1
01	1	0	1	0
11	x	x	x	x
10	1	1	x	x

$\overline{A2} + \overline{A1}\,\overline{A0} + A1\,A0$

Output: C

Format: Sum of products

A3, A2 \ A1, A0	00	01	11	10
00	1	1	1	0
01	1	1	1	1
11	x	x	x	x
10	1	1	x	x

$\overline{A1} + A0 + A2$

7SEGMANT K-MAPS

Output: D

Format: Sum of products

A3, A2 \ A1, A0	00	01	11	10
00	1	0	1	1
01	0	1	0	1
11	x	x	x	x
10	1	0	x	x

$\overline{A2}\,\overline{A0} + \overline{A2}\,A1 + A1\,\overline{A0} + A2\,\overline{A1}\,A0$

Output: E

Format: Sum of products

A3, A2 \ A1, A0	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	x	x	x	x
10	1	0	x	x

$\overline{A2}\,\overline{A0} + A1\,\overline{A0}$

Output: F

Format: Sum of products

A3, A2 \ A1, A0	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	x	x	x	x
10	1	1	x	x

$\overline{A1}\,\overline{A0} + A2\,\overline{A1} + A2\,\overline{A0} + A3$

Output: G

Format: Sum of products

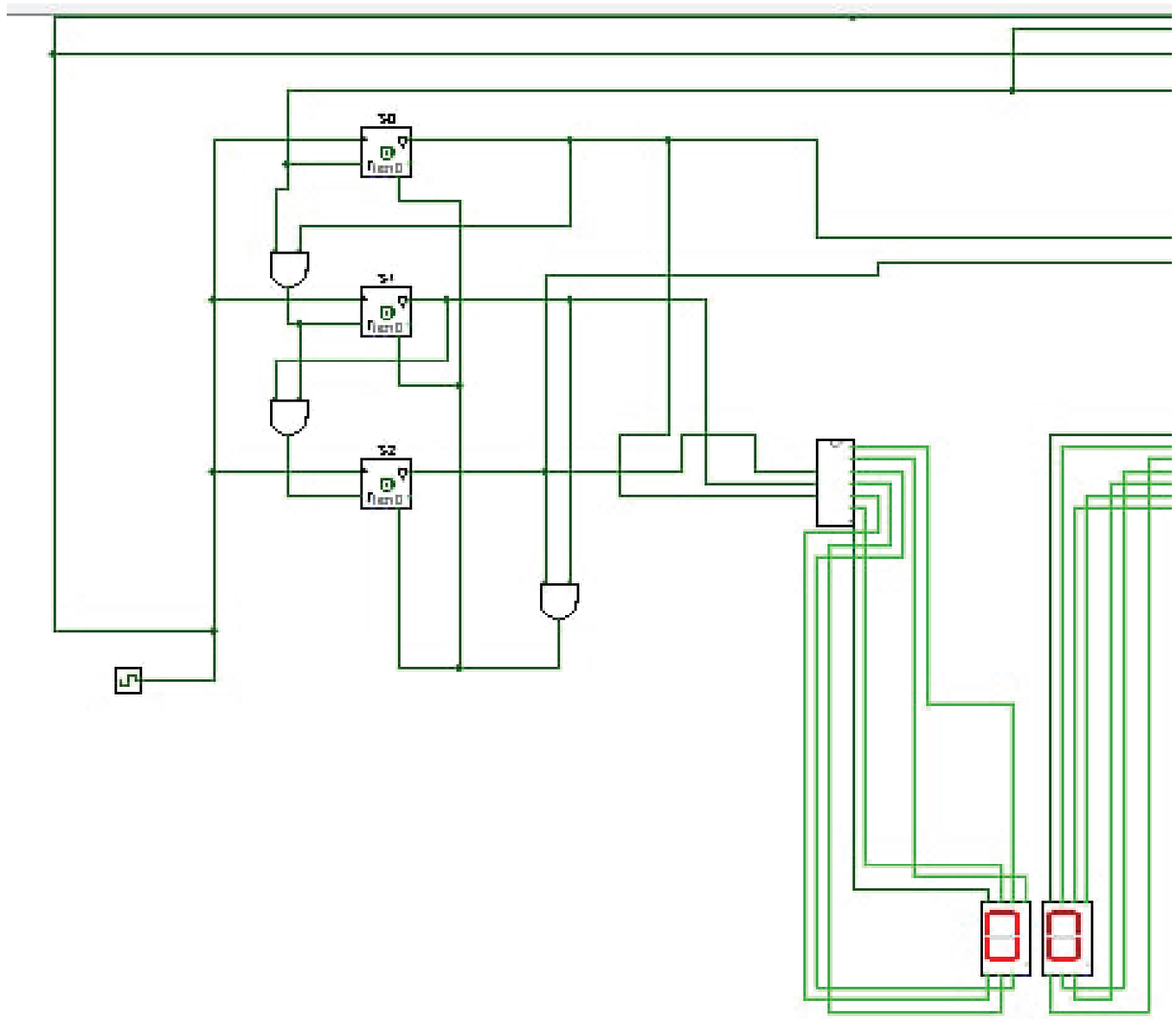
A3, A2 \ A1, A0	00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	x	x	x	x
10	1	1	x	x

$\overline{A2}\,A1 + A2\,\overline{A1} + A2\,\overline{A0} + A3$

BCD TO 7 SEGMANT

A3	A2	A1	A0	A	B	C	D	E	F	G
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	0	0	1	1
1	0	1	0	x	x	x	x	x	x	x
1	0	1	1	x	x	x	x	x	x	x
1	1	0	0	x	x	x	x	x	x	x
1	1	0	1	x	x	x	x	x	x	x
1	1	1	0	x	x	x	x	x	x	x
1	1	1	1	x	x	x	x	x	x	x

SECONDS “TENS“



THEY HAVE 3 INPUTS:

T_0 T1 T2

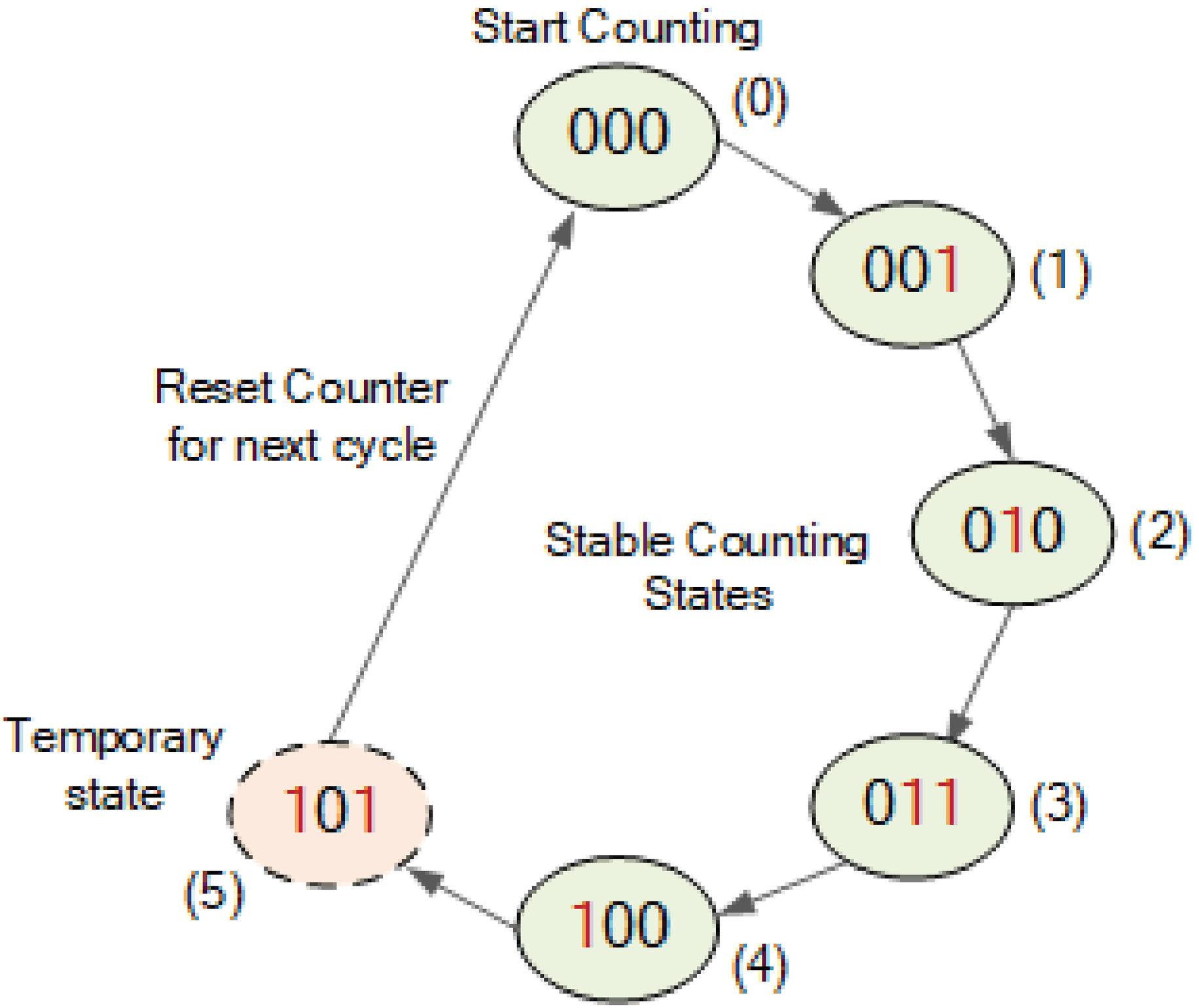
AND HAVE 4 OUTPUTS:

Q_0 Q1 Q2

AS:

$T_0 = A_3 A_0$
$T_1 = Q_0 T_0$
$T_2 = Q_0 Q_1 T_0$

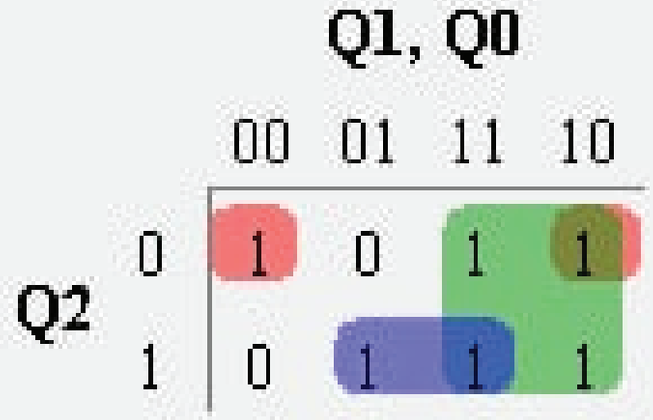
STATE DIAGRAM



7 SEGMANT K-MAPS

Output: A

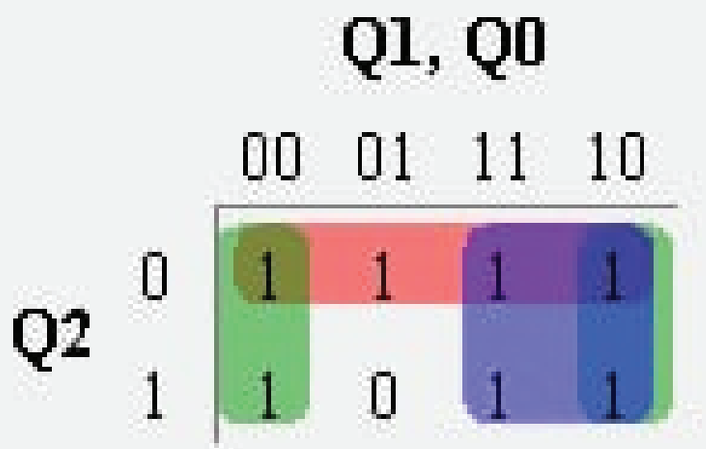
Format: Sum of products



$\overline{Q2}\,\overline{Q0} + Q1 + Q2\,Q0$

Output: B

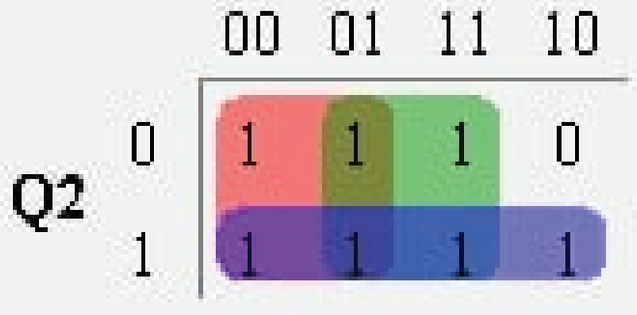
Format: Sum of products



$\overline{Q2} + \overline{Q0} + Q1$

Output: C

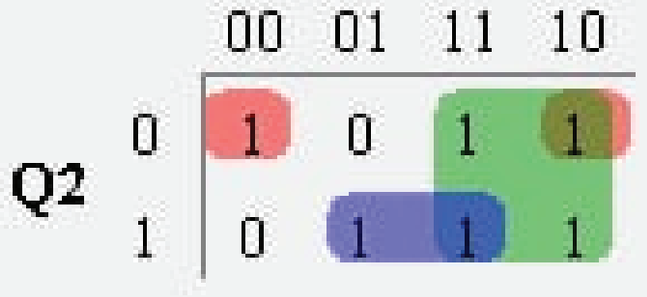
Format: Sum of products



$\overline{Q1} + Q0 + Q2$

Output: D

Format: Sum of products

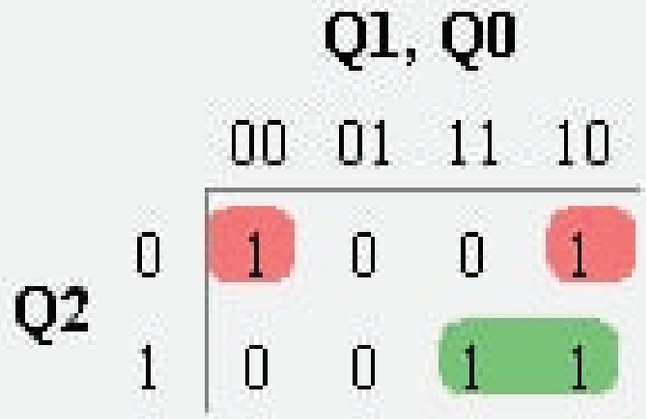


$\overline{Q2}\,\overline{Q0} + Q1 + Q2\,Q0$

7 SEGMANT K-MAPS

Output: E

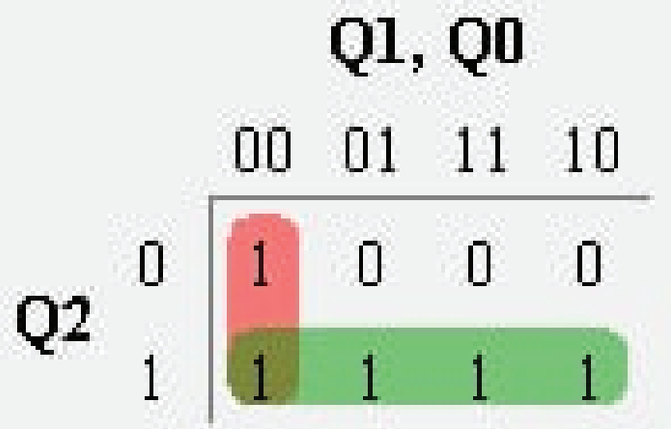
Format: Sum of products



$\overline{Q2}\,\overline{Q0} + Q2\,Q1$

Output: F

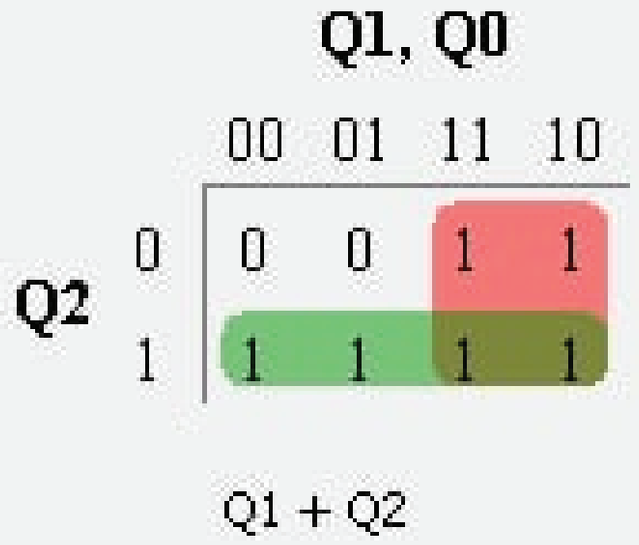
Format: Sum of products



$\overline{Q1}\,\overline{Q0} + Q2$

Output: G

Format: Sum of products



$Q1 + Q2$

BCD TO 7 SEGMANT

Q2	Q1	Q0	A	B	C	D	E	F	G
0	0	0	1	1	1	1	1	1	0
0	0	1	0	1	1	0	0	0	0
0	1	0	1	1	0	1	1	0	1
0	1	1	1	1	1	1	0	0	1
1	0	0	0	1	1	0	0	1	1
1	0	1	1	0	1	1	0	1	1
1	1	0	x	x	x	x	x	x	x
1	1	1	x	x	x	x	x	x	x

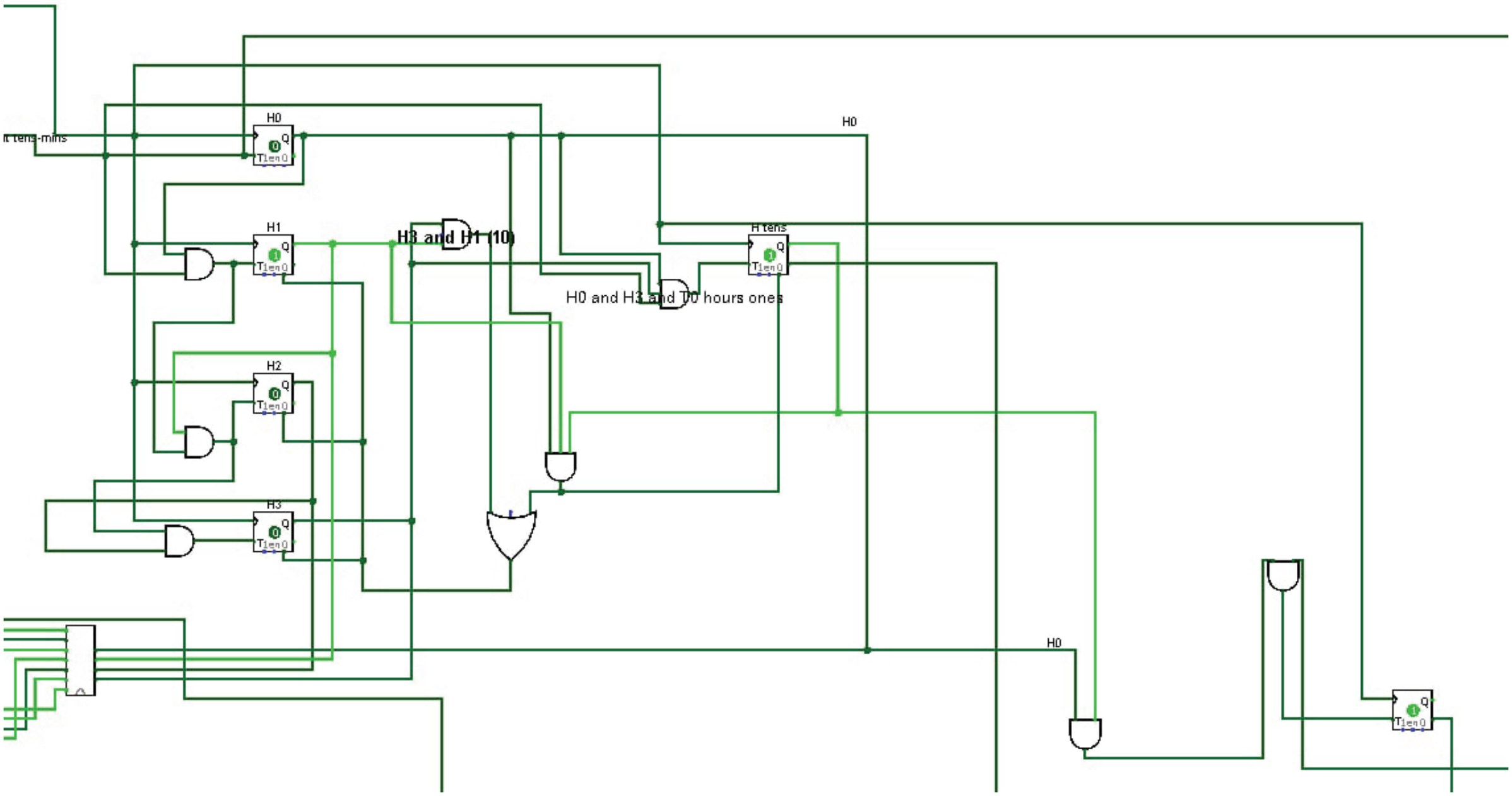
MINUTES “ONES & TENS”

WE WILL TAKE THE NEXT OUTPUT FROM SECONDS ONES AND TENS ، IN ORDER TO GET THE TENS MINUTES, WE ADD A0 AND A3 BY USING AND GATE WITH THE OUTPUT COMING FROM MINUTES ONES.

WE NOTE THAT THE MINUTES ONES AND TENS HAVE THE SAME STATE DIGARAM AND THE SAME K-MAPS AS IN SECONDS ONES AND TENS

HOURS “ONES & TENS”

MANUFACTURING 4 FLIP FLOP T-TYPE



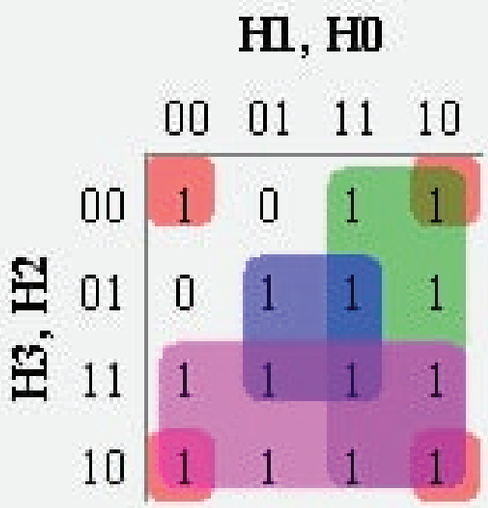
BCD TO 7 SEGMANT

H3	H2	H1	H0	a	b	c	d	e	f	g
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	0	0	1	1
1	0	1	0	1	1	0	1	1	1	1
1	0	1	1	1	1	1	1	0	1	1
1	1	0	0	1	1	1	0	0	1	1
1	1	0	1	1	0	1	1	0	1	1
1	1	1	0	1	0	1	1	1	1	1
1	1	1	1	1	1	1	0	0	1	1

7 SEGMANT K-MAPS

Output: a

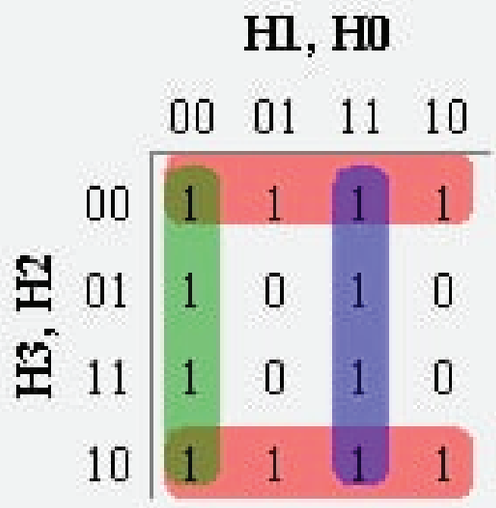
Format: Sum of products



$\overline{H2}\,H0 + H1 + H2\,\overline{H0} + H3$

Output: b

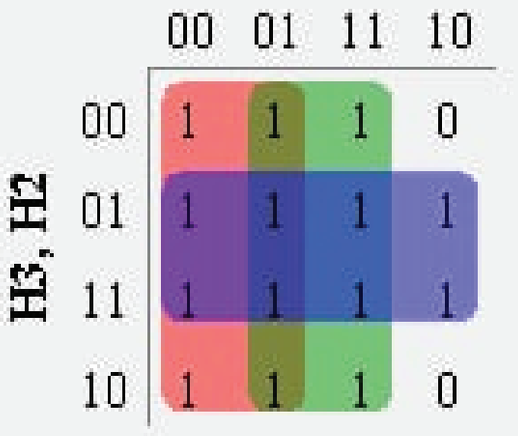
Format: Sum of products



$H2 + H1\,\overline{H0} + \overline{H1}\,H0$

Output: c

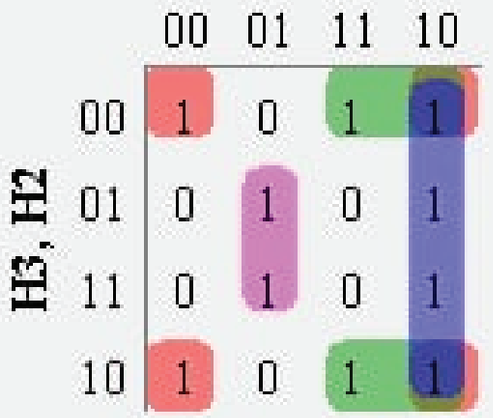
Format: Sum of products



$\overline{H1} + H0 + H2$

Output: d

Format: Sum of products



$\overline{H2}\,\overline{H0} + \overline{H2}\,H1 + H1\,\overline{H0}$
$+ H2\,\overline{H1}\,H0$

7 SEGMANT K-MAPS

Output: e

Format: Sum of products

H1, H0

H3, H2 \ H1, H0	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	0	0	0	1
10	1	0	0	1

$\overline{H2}\,\overline{H0} + H1\,\overline{H0}$

Output: f

Format: Sum of products

H1, H0

H3, H2 \ H1, H0	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	1	1	1	1
10	1	1	1	1

$H1\,H0 + H2\,H1 + H2\,H0 + H3$

Output: g

Format: Sum of products

H1, H0

H3, H2 \ H1, H0	00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	1	1	1	1
10	1	1	1	1

$\overline{H2}\,H1 + H2\,\overline{H1} + H2\,\overline{H0} + H3$

AM & PM

WHEN WE WANT TO CHANGE BETWEEN, PM AND AM, WE NEED 7 SEGMENT, AND IT WILL BE ON P BY DEFAULT, AND IN ORDER TO CHANGE THE MODE FROM PM TO AM, THE OUTPUT COMING FROM THE HOUR MUST BE EQUAL TO 11:59:59, THEN THE P WILL CHANGE TO A.

SOURCES

DR. MOHAMED HAMDY LECUTURES

LOGIC AND COMPUTER DESIGN FUNDAMENTALS 5TH ED BY MORRIS R. MANO, CHARLES R. KIME