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Subject: Digital Logic [CG 2102]

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Q.1) a) given $\sqrt{22} = 6$, to find base

$$\therefore 22 = 36$$

or $2d + 2 = 36$, where d is the base.

$$2d = 34$$

$$d = 17$$

 \therefore Unknown base = 17

b) to perform BCD addition of 28 and 39.

$$28 \rightarrow 0010 \quad 1000$$

$$39 \rightarrow 0011 \quad 1001$$

$$\begin{array}{r} \begin{array}{cc} & 1 \\ 0011 & 1001 \\ + 0010 & 1000 \\ \hline 0101 & 0001 \end{array} \end{array}$$

 \rightarrow Carry generated, add to 0110

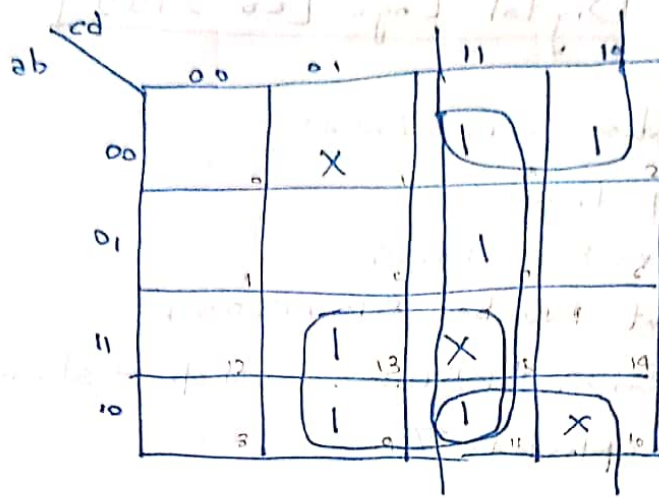
$$\begin{array}{r} 0110 \quad 0001 \\ + \quad \quad 0110 \\ \hline 0110 \quad 0111 \end{array}$$

and $0110 \ 0111 \rightarrow 67$

$$\therefore 28 + 39 = 67$$

Pg 1

$$c) f(a, b, c, d) = \sum m(2, 3, 7, 9, 11, 13) + \sum d(1, 10, 15)$$



$$\therefore f(a, b, c, d) = ad + cd + b'c$$

3) given state table

PS	NS		Output
	n=0	n=1	
A	D	C	0
B	F	H	0
C	E	D	1
D	A	E	0
E	C	A	1
F	F	B	1
G	B	H	0
H	C	G	1

→ drawing Implication Table.

B	D-F C-H						
E	X	X					
AD	A-D C-E	F-A H-E	X				
E	X	X	C-E A-D	X			
F	X	X	E-F D-B	X	C-F A-B		
G	D-B C-H	F-B	X	A-B E-H	X	X	
H	X	X	C-E D-G	X	A-G	F-G B-G	X
	A	B	C	D	E	F	G

→ Equivalent States: $A \equiv D$
 $C \equiv E$

Q4) ~~Count~~

1	3	5	7
1	X	1	X

1	1	1	1
1	1	1	1

Q4) given Counter Sequence: 0, 4, 2, 6, repeat [JK]

Counter Sequence	Q_2	Q_1	Q_0	J_2	K_2	J_1	K_1	J_0	K_0
0	0	0	0	1	X	0	X	0	X
4	1	0	0	X	1	1	X	0	X
2	0	1	0	1	X	1 X	0	0	X
6	1	1	0	X	1	X	1	0	X
US [1]	0	0	1	0	X	0	X	X	1
US [3]	0	1	1	0	X	X	1	X	1
US [5]	1	0	1	X	1	0	X	X	1
US [7]	1	1	1	X	1	X	1	X	1

→ Assumed all the unused state resets the counter

now using

I) J_2

		Q_1, Q_0			
Q_2	0	00	01	11	10
	1	X	X	X	X

$$J_2 = Q_0'$$

II) K_2

		Q_1, Q_0			
Q_2	0	00	01	11	10
	1	X	X	X	X

$$K_2 = 1$$

III) J_1

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

$$J_1 = Q_2 Q_0'$$

IV) K_1

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

$$K_1 = Q_2 + Q_1 Q_0$$

V) J_0

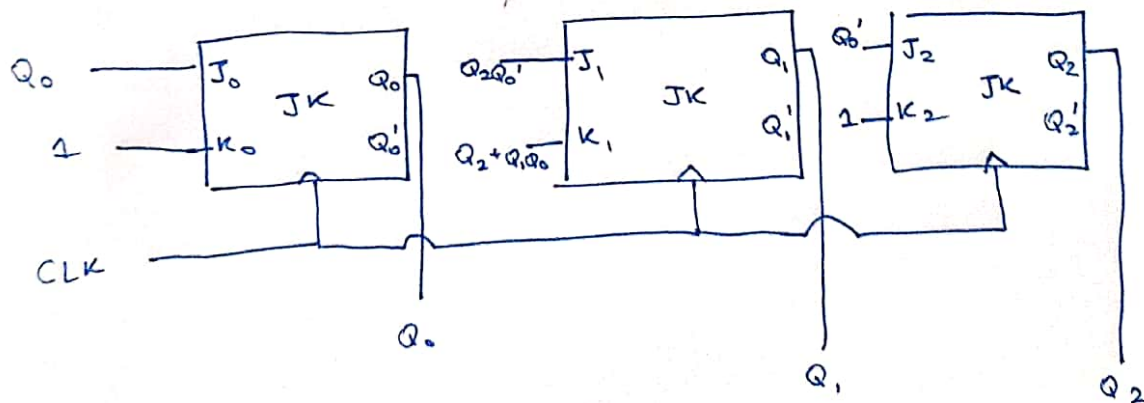
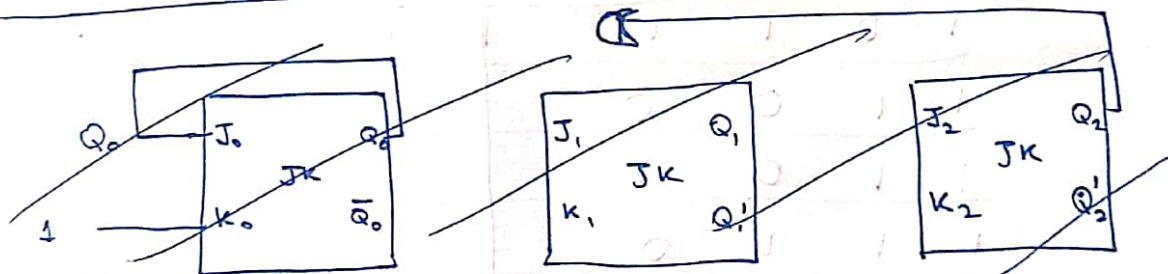
$Q_2 \backslash Q_1 Q_0$	00	01	11	10
0			X	X
1			X	X

$$J_0 = Q_0$$

VI) K_0

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

$$K_0 = 1$$



2) given ~~two~~ BCD digit, output 1, when unused

A	Q_3	Q_2	Q_1	Q_0	output
0	0	0	0	0	0
0	0	0	0	1	0
0	0	0	1	0	0
0	0	0	1	1	0
0	0	1	0	0	0
0	0	1	0	1	0
0	0	1	1	0	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	0	1	0
0	1	0	1	0	1
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	0	1	1
0	1	1	1	0	1
0	1	1	1	1	1

Truth Table for $f(Q_3, Q_2, Q_1, Q_0)$:

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

$$f(Q_3, Q_2, Q_1, Q_0) = Q_3 Q_2 + Q_3 Q_1$$

$$= Q_3 (Q_2 + Q_1)$$

$$= Q_3 [Q_2' \cdot Q_1']'$$

$$= \left[Q_3 [Q_2' \cdot Q_1']' \right]'$$

