DESIGNING AN ALARM CLOCK USING SYNCHRONOUS UP COUNTER
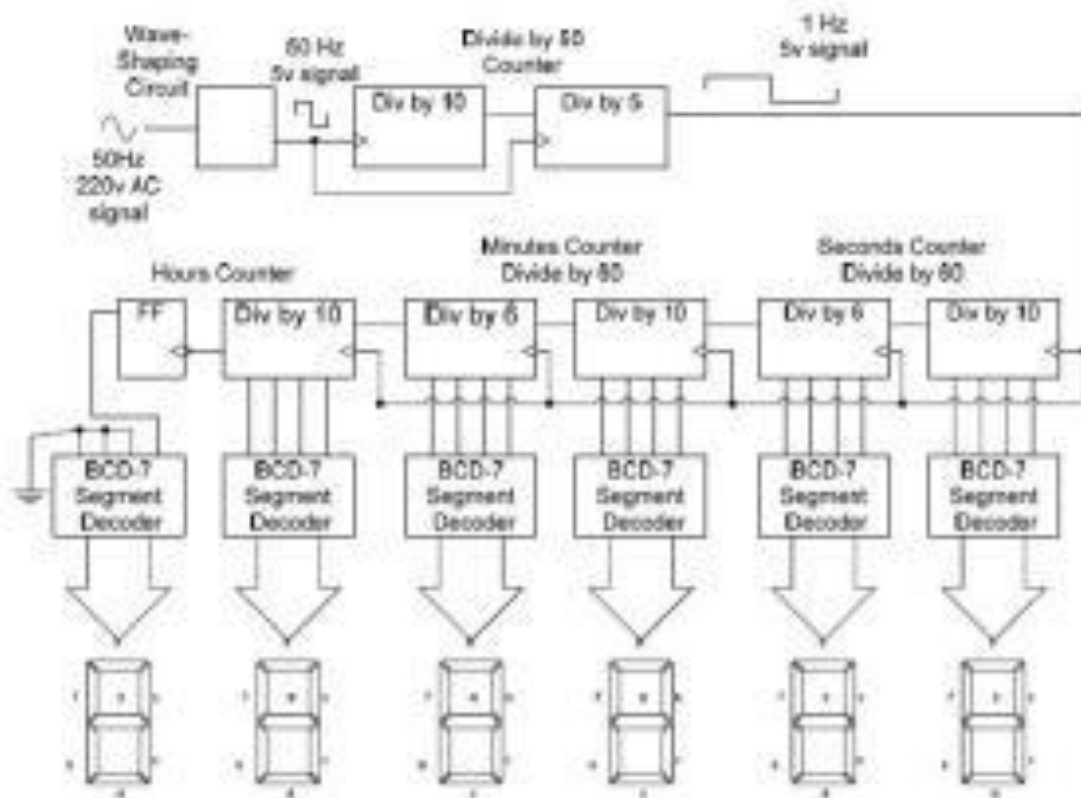
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DESIGN OF THE ALARM CLOCK

Here, we make an hour counter alarm clock to count time using seven segment decoders, T flip flops. And we use six separate seven segment displays to display seconds,minutes and hours of a day. The design of the circuit is following.

Designing the 3 – bit synchronous up counter

(1) Number of bits – 3
(2) Number of states – 8 states(2^3 states)
(3) Number of outputs – 3 outputs (Q1,Q2,Q3)

First we have to look at the state diagram of 3-bit counter.
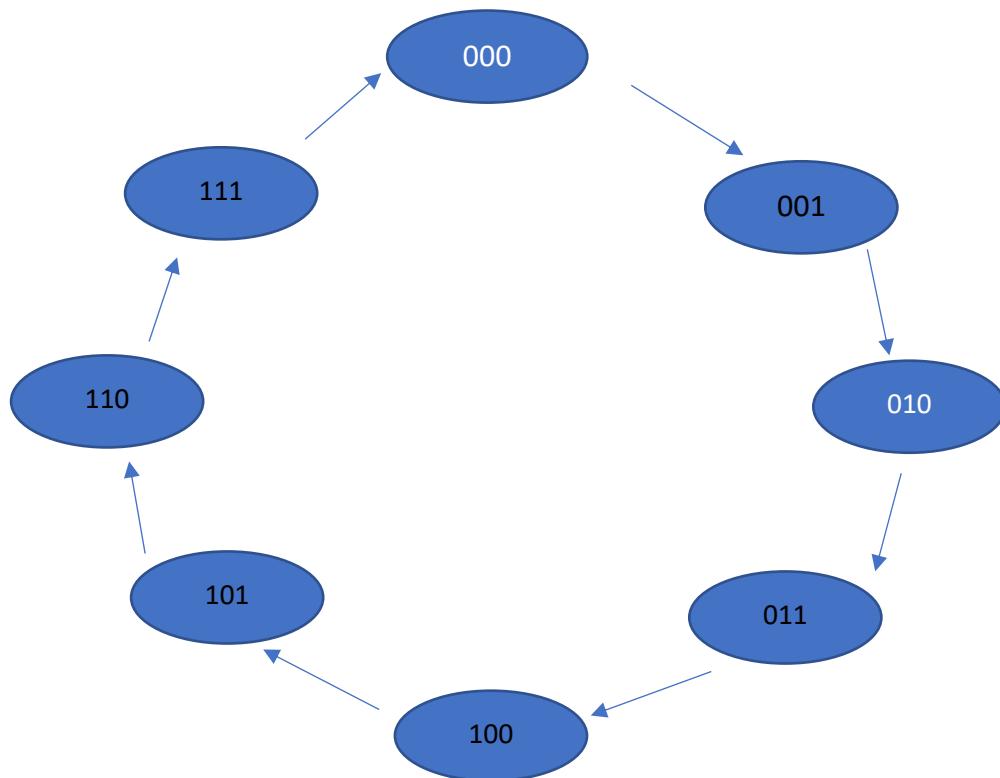
Here , we use T flip flops to make this counter.

Excitation table of T flip flop

Q(t)	Q(t+1)	T
0	0	0
0	1	1
1	0	1
1	1	0

Characteristic table

Q₃(t)	Q₂(t)	Q₁(t)	Q₃(t+1)	Q2(t+1)	Q1(t+1)	T₃	T₂	T₁
0	0	0	0	0	1	0	0	1
0	0	1	0	1	0	0	1	1
0	1	0	0	1	1	0	0	1
0	1	1	1	0	0	1	1	1
1	0	0	1	0	1	0	0	1
1	0	1	1	1	0	0	1	1
1	1	0	1	1	1	0	0	1
1	1	1	0	0	0	1	1	1

Then draw K-Maps and find logical equations using the above characteristic table. Finally can draw the logic circuit.
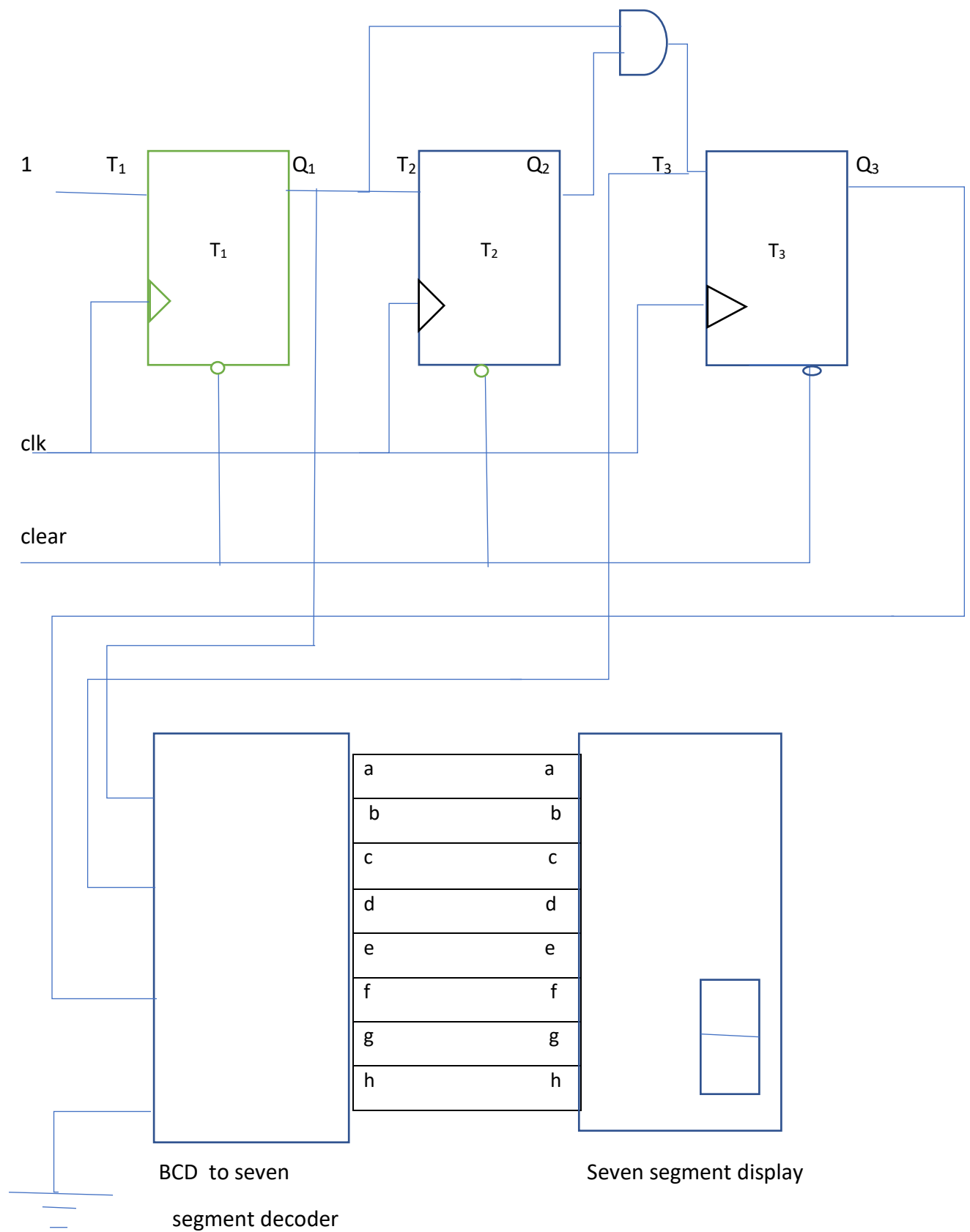
Q_3 \ $Q_2 Q_1$

	00	01	11	10
	0	0	1	0
	0	0	1	0

$T_3 = Q_2.Q_1$

Q_3 \ $Q_2 Q_1$

	00	01	11	10
	0	1	1	0
	0	1	1	0

$T_2 = Q_1$

Q_3 \ $Q_2 Q_1$

1	1	1	1
1	1	1	1

$T_1 = 1$

1   T₁   Q₁   T₂   Q₂   T₃   Q₃

T₁   T₂   T₃

clk

clear

a	a
b	b
c	c
d	d
e	e
f	f
g	g
h	h

BCD to seven

segment decoder

Seven segment display

Applications Of Synchronous Counters

As the name suggest, Synchronous counters perform " counting " such as time as and electronic pulses (external source like infrared light). They are widely used in lots of other designs aas well such as processors, calculators, real time clock etc. Some common uses and application of synchronous counters are follow.

- Alarm clock, Set AC Timer, set time in camera to take the picture, flashing light indicator in automobiles, car parking control
- The up/down counter can be used as a self reversing counter
- Used to generate saw-tooth waveform
- Used in digital to analog converters
- Used as clock divider circuit
- Used in machine moving control