Project -02

Counters

COUNTER – It is the logical circuit which is used to count the numbers of ripples. It is the combinations of various basic, and universal logic gates and seven segment lights. It starts counting from 0 to F=15,

There are two types of counters

1. Synchronous
2. Asynchronous

It is further divided into the up or down counter.

Here we have designed a synchronous up counter.

Synchronous:- The counter in which same clock is applied to the all flip-flops, and it counts up to the numbers from where up to we want.

Asynchronous :- The counter in which the clock is applied to only on the least significant bit flip-flop, and output of the 1 st ff will be the input of the next ff, these is how we obtain the counting,

1. If there is positive edge trigging
   - When Q is connected as the input of the next ff then it will be a down counter.
   - When complement of Q is connected as the input of the next ff then it will be the up counter.
2. If there is negative edge trigging
   - When Q is connected as the I put of the next ff then it will be the UP-Counter.
   - When complement if the Q is connected as the input of the next ff then it will be a DOWN-COUNTER.

UP-COUNTER :- It counts from 0 to n.

DOWN-COUNTER:- It counts from n to 0.

REQUIREMENT

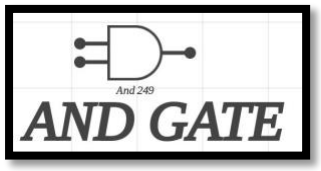
S.NO.	Name	Quantity
1	**AND GATE**	2
2	**JK FLIP-FLOP**	4
3	**IC**	1
4	**Seven segment light**	1
5	**Connecting wires**	As required

AND GATE:-

Ii is one of the basic logic gate. Which performs the logical operations based on their input.

If the both inputs are high then the output will be high, and if any of the input is high then output will be low.

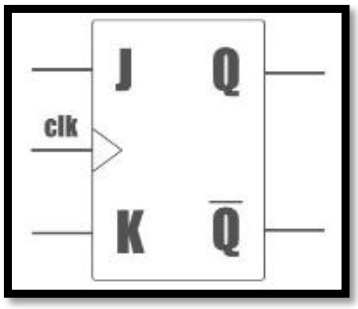
TRUTH TABLE: 1= high, 0= low

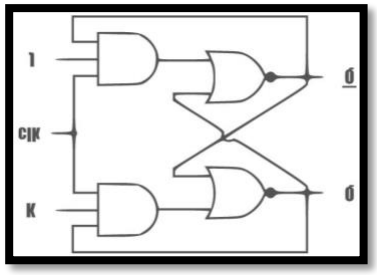


A=input1	B=input2	Y=output
0	0	0
0	1	0
1	0	0
1	1	1

JK FLIP-FLOP :- It is the combination of the NAND logic, which can store the data up to 1 bit only. It is designed with NAND S-R LATCH with clock trigging.

As shown in figure and the truth table is as :-

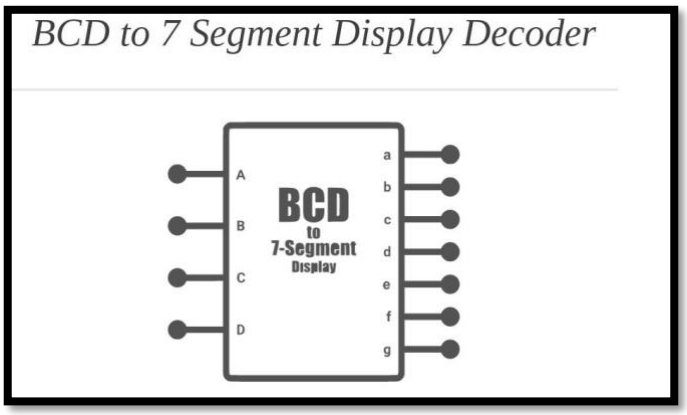




CLOCK	J	K	Qn	$Qn+1$
0	0	0	Latch	Latch
0	0	1	Latch	Latch
0	1	0	Latch	Latch
0	1	1	Latch	Latch
1	0	0	Latch	Latch
1	0	1	0	1
1	1	0	1	0
1	1	1	Toggle	Toggle

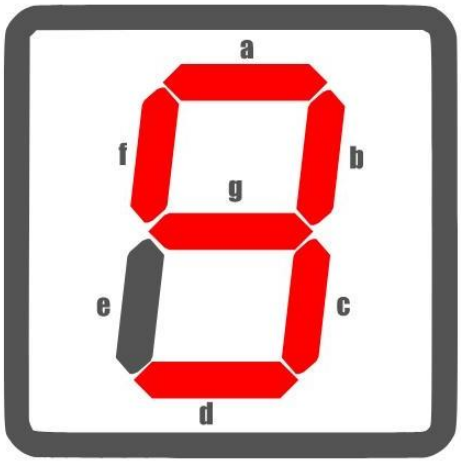
IC-7447It is also known as the BCD – SEVEN SEGMENT

A BCD Seven segment decoder is a combinational logic circuit that accepts a decimal digit in BCD and generates appropriate output for the segment to display the input decimal digit.



SEVEN SEGMENT DISPLAY:-

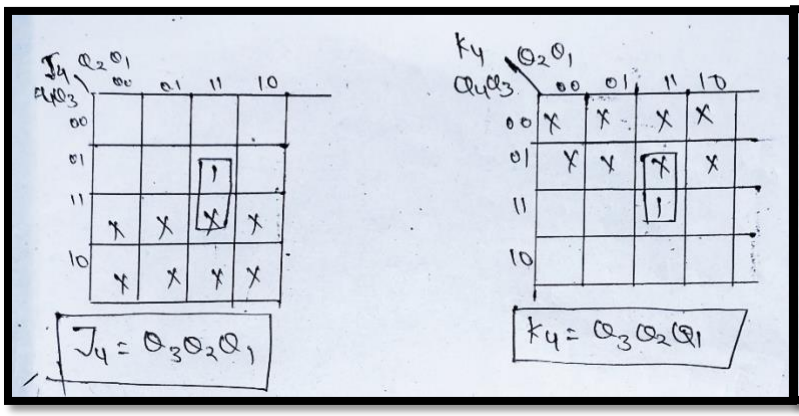
It is the form of electronic display device for display numerals . Displays are widely used in digital clocks, electronic meters, basic calculators, and other electronic devices. It may be of Liquid crystal diode(LCD), alight emitting diode (LED)

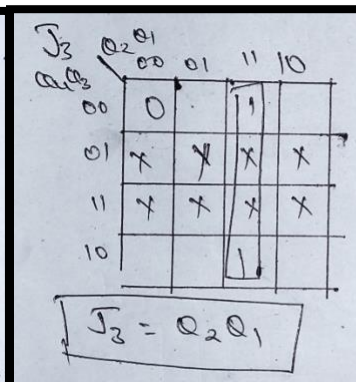


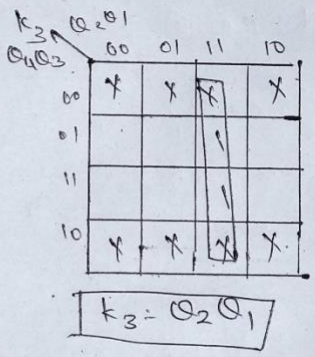
TRUTH TABLE FOR UP COUNTER 0-15

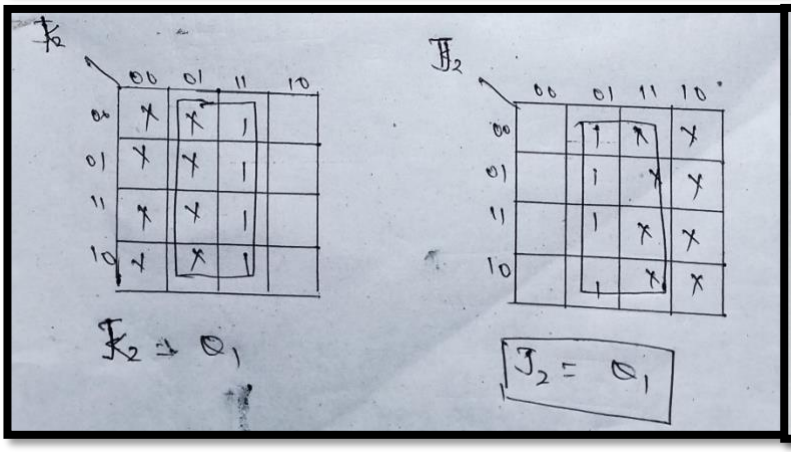
I\P decimal	Q4	Q3	Q2	Q1	Q4+	Q3+	Q2+	Q1+	J4	K4	J3	K3	J2	K2	J1	K1	O\P decimal
0	0	0	0	0	0	0	0	1	0	x	0	x	0	x	1	x	1
1	0	0	0	1	0	0	1	0	0	x	0	x	1	x	x	1	2
2	0	0	1	0	0	0	1	1	0	x	0	x	x	0	1	x	3
3	0	0	1	1	0	1	0	0	0	x	1	x	x	1	x	1	4
4	0	1	0	0	0	1	0	1	0	x	x	0	0	x	1	x	5
5	0	1	0	1	0	1	1	0	0	x	x	0	1	x	x	1	6
6	0	1	1	0	0	1	1	1	0	x	x	0	x	0	1	x	7
7	0	1	1	1	1	0	0	0	1	x	x	1	x	1	x	1	8
8	1	0	0	0	1	0	0	1	x	0	0	x	0	x	1	x	9
9	1	0	0	1	1	0	1	0	x	0	0	x	1	x	x	1	A=10
10	1	0	1	0	1	0	1	1	x	0	0	x	x	0	1	x	B=11
11	1	0	1	1	1	1	0	0	x	0	1	x	x	1	x	1	C=12
12	1	1	0	0	1	1	0	1	x	0	x	0	0	x	1	x	D=13
13	1	1	0	1	1	1	1	0	x	0	x	0	1	x	x	1	E=14
14	1	1	1	0	1	1	1	1	x	0	x	0	x	0	1	x	F=15
15	1	1	1	1	0	0	0	0	x	1	x	1	x	1	x	1	0

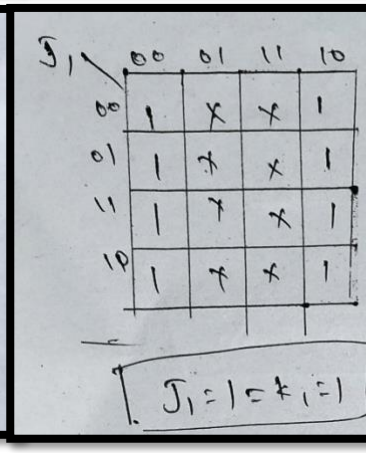
With the help of K-Map we solved the above expression as follows:

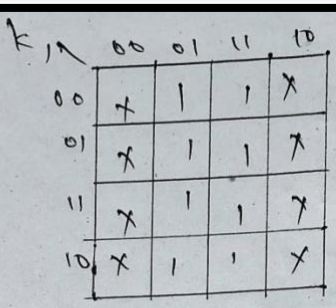




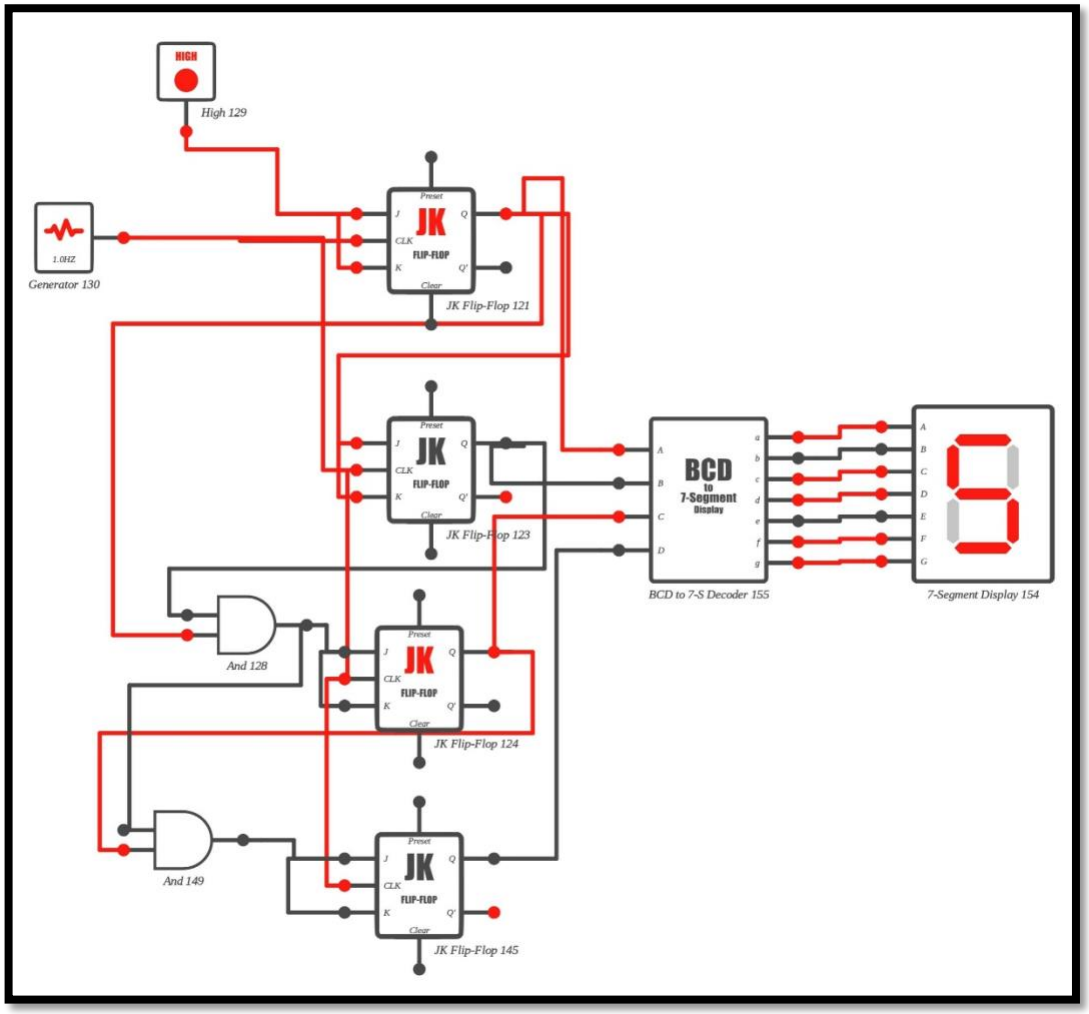








NOW THE CIRCUIT CAN BE DERIVED AS :



RESULT : WE HAVE SUCCESSFULLY DESIGNED THE 4-BIT SYNCHRONOUS UP-COUNTER.