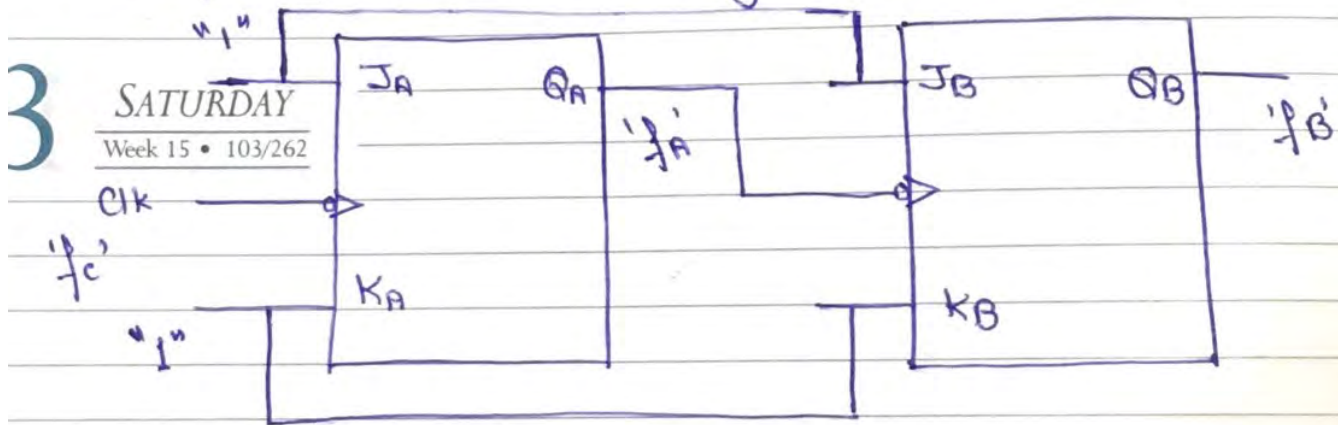


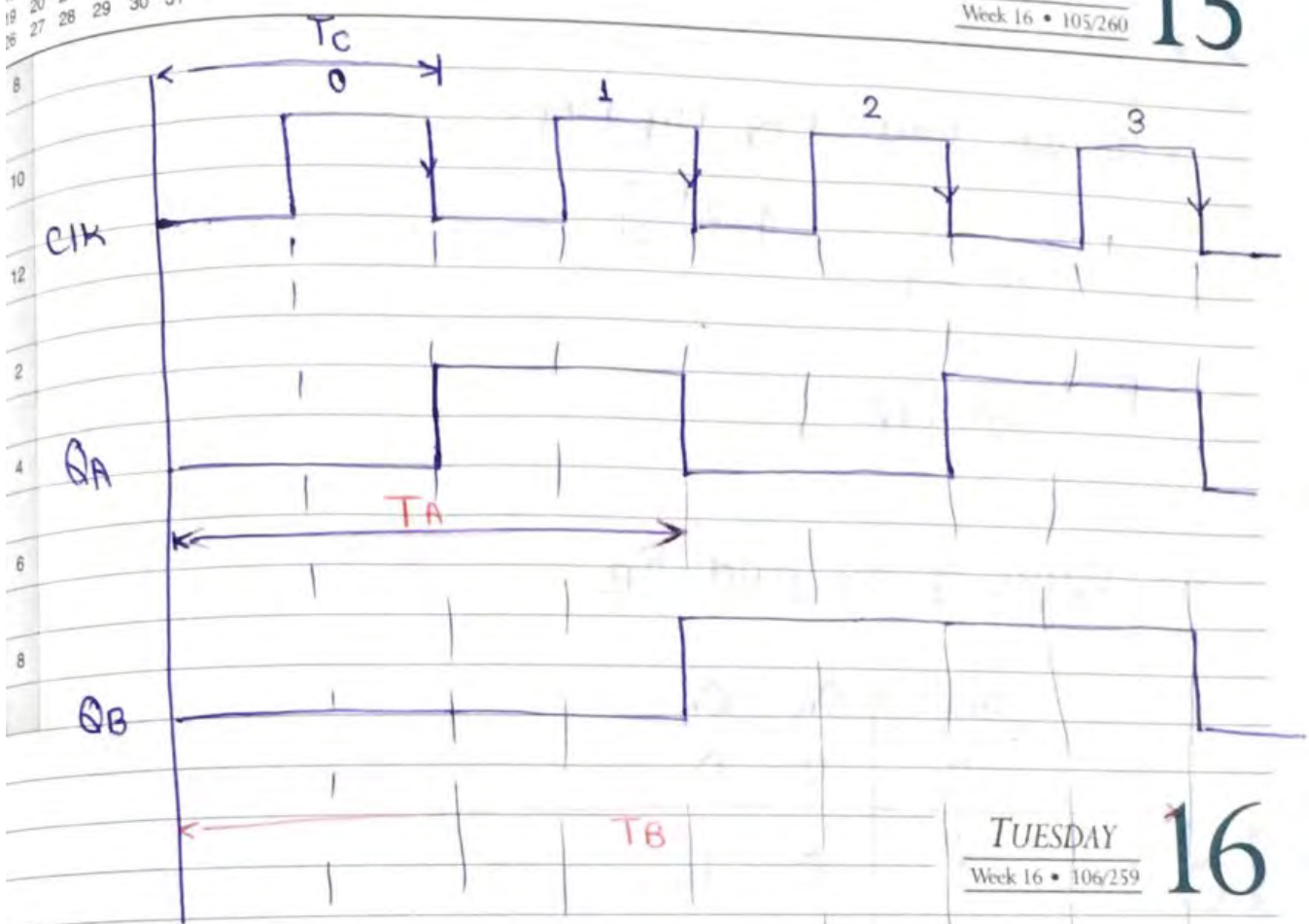
COUNTERS

★

- Counter is a sequential circuit. A digital circuit which is used for a counting pulses is known a counter.
- Counter is the widest application of flip flops.
- It is a group of flip flops with a clock signal applied.
- Flip Flop as divide by 2 ckt.



MAY							
S	M	T	W	T	F	S	
			1	2	3	4	
5	6	7	8	9	10	11	
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30	31		



As, $T_A = 2 T_c$

$$\frac{1}{f_A} = \frac{2}{f_c}$$

$$f_A = f_c / 2$$

$T_B = 2 T_A$

$$\frac{1}{f_B} = \frac{2}{f_A}$$

$$f_B = \frac{f_A}{2} = \frac{f_c}{4}$$

• If we have P of Flip Flops

$$P=2$$

$$[2^P]$$

$$2^2 = 4$$

$$P=4$$

$$2^4 = 16$$

→ Values of Q_A and Q_B

CLK	Q_B	Q_A
0	0	0
1	0	1
2	1	0
3	1	1

18

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• for 0 to 15

4 Flip Flops required

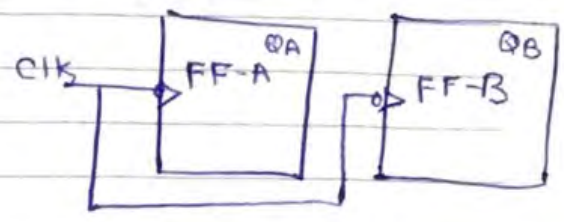
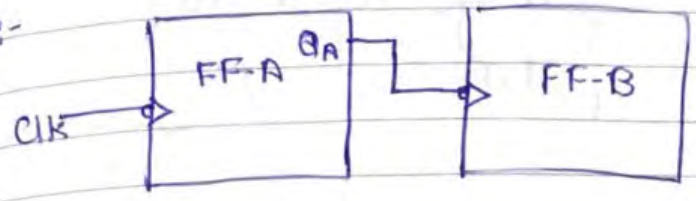
$$\boxed{2^4 = 16}$$

Types of Counters

Asynchronous Counters
 or
 Ripple Counters

Synchronous Counters

Eg:-



- Flip Flops are connected in such a way that the O/P of first FF drives the clock of next flip flop.

- There is no connection between O/P of 1st FF and clock of next FF. **20**
 Beoz clock is given simultaneously to all the Flip Flop.

- Flip Flops are not clocked simultaneously.

- Flip Flops are clocked simultaneously.

- Circuit is simple for more number of states

- Circuit becomes complicated as number of states ↑ses.

- Speed is slow as clock is propagated through number of stages.

- Speed is high as clock is given at a same time.

Types of Counters (Asyn. / Syn.)

On the way counting is progressing

UP Counters

DOWN Counters

UP-DOWN Counters

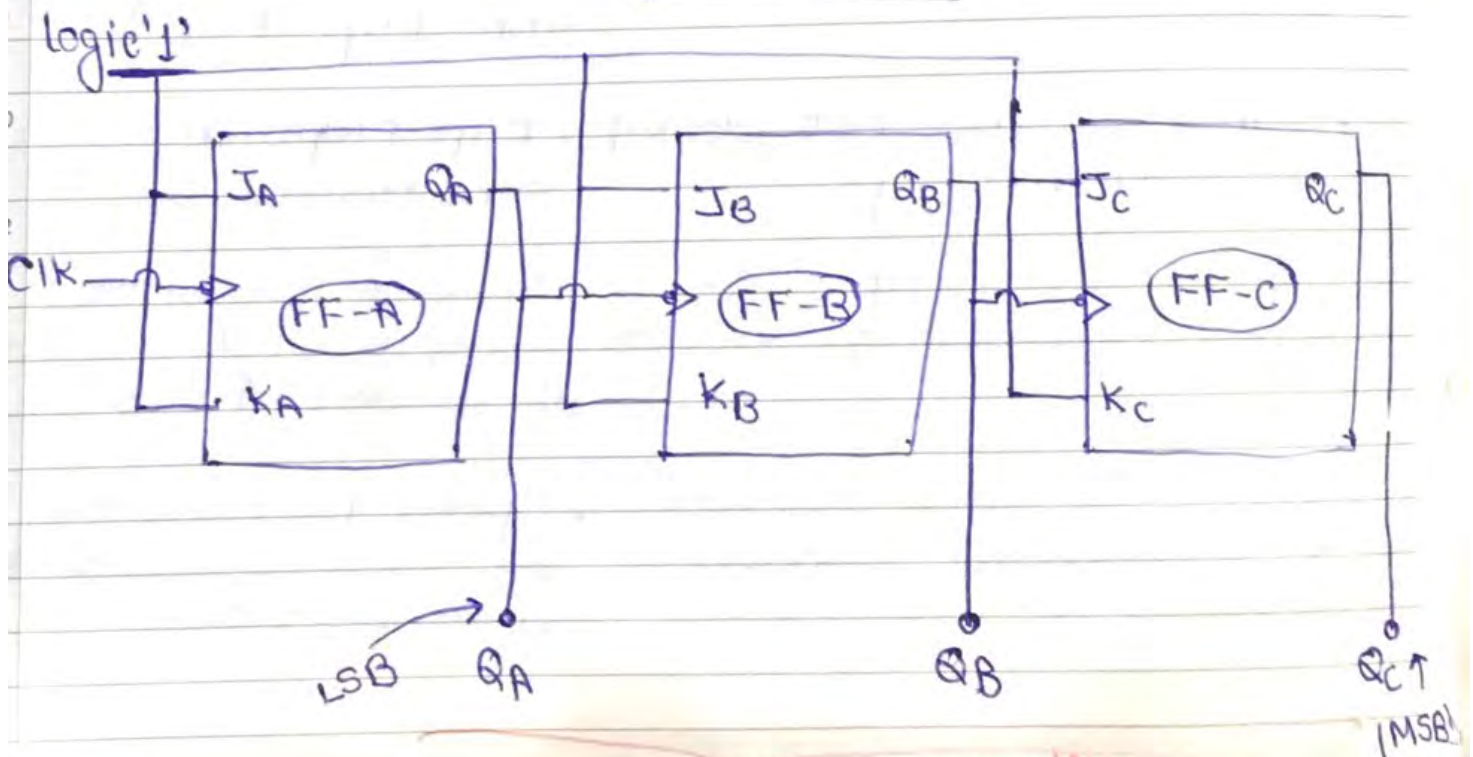
Small to high
0, 1, 2, 3, ...

Large to Small
7, 6, 5, ..., 0

Combination of UP and DOWN

3-BIT ASYNCHRONOUS UP

COUNTER



Counter o/p's

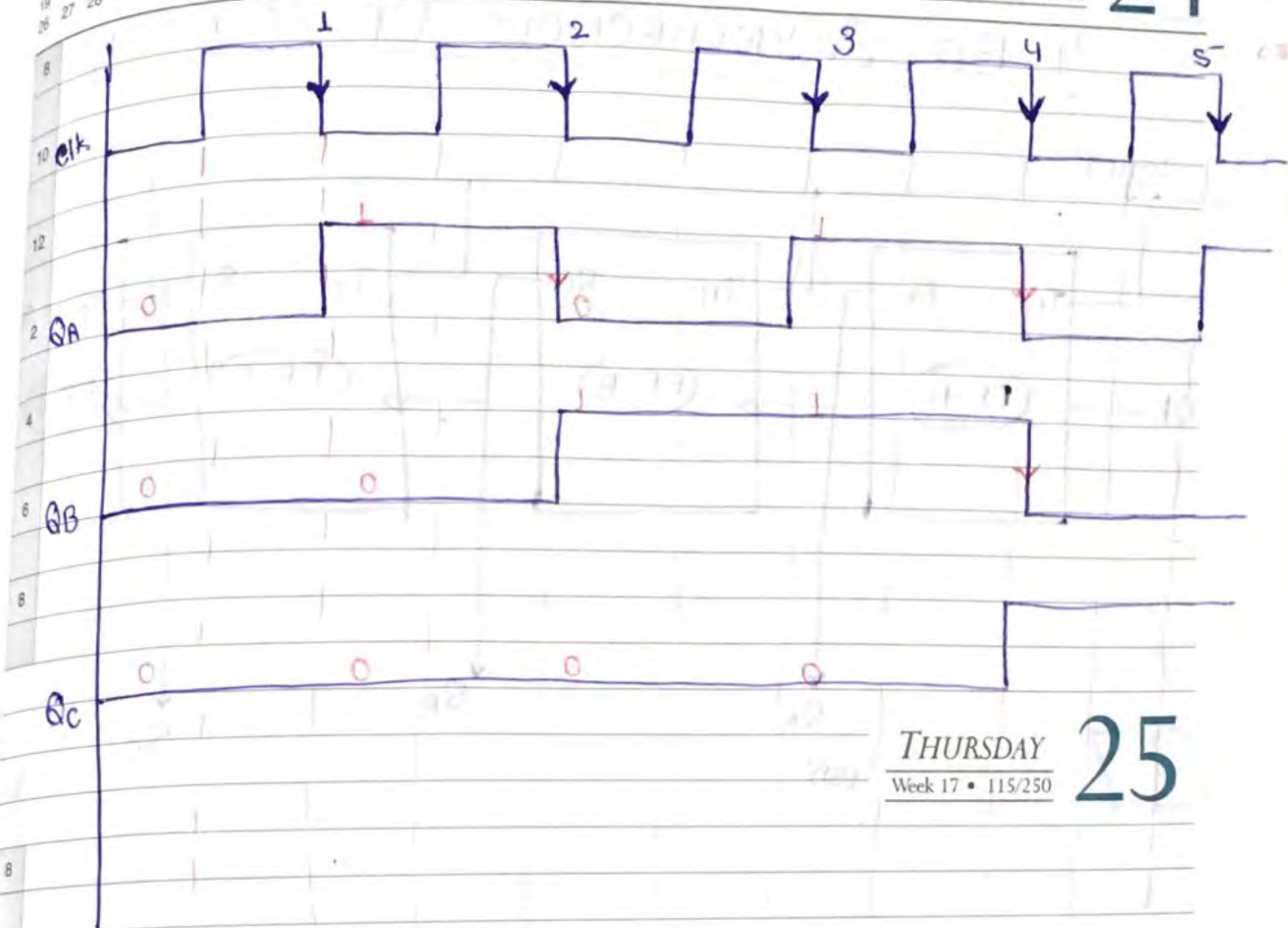


Table :->

clock	QC	QB	QA	Decimal Eq ⁿ .
Initially	0	0	0	0
1 st (↓)	0	0	1	1
2 nd (↓)	0	1	0	2
3 rd (↓)	0	1	1	3
4 th (↓)	1	0	0	4
5 th (↓)	1	0	1	5
6 th (↓)	1	1	0	6
7 th (↓)	1	1	1	7
8 th (↓)	0	0	0	0

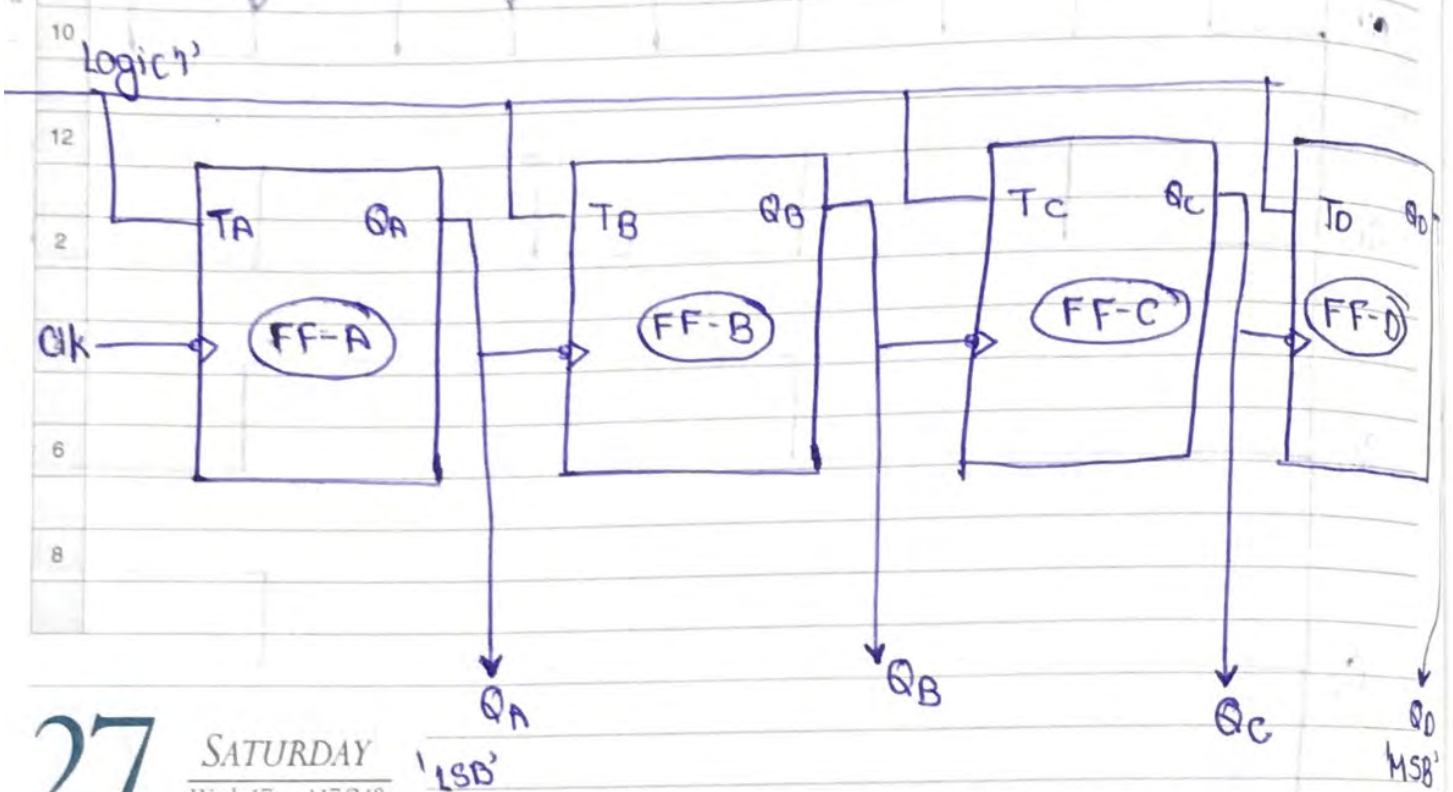
8 states
all
they
 $2^P = 2^3$
= 8

Max. Count = $2^n - 1 = 8 - 1 = 7$ } n is no. of FF used }

MAY

JUN

4 BIT ASYNCHRONOUS UP COUNTER



8				
10				
12				
2				
4				
6				