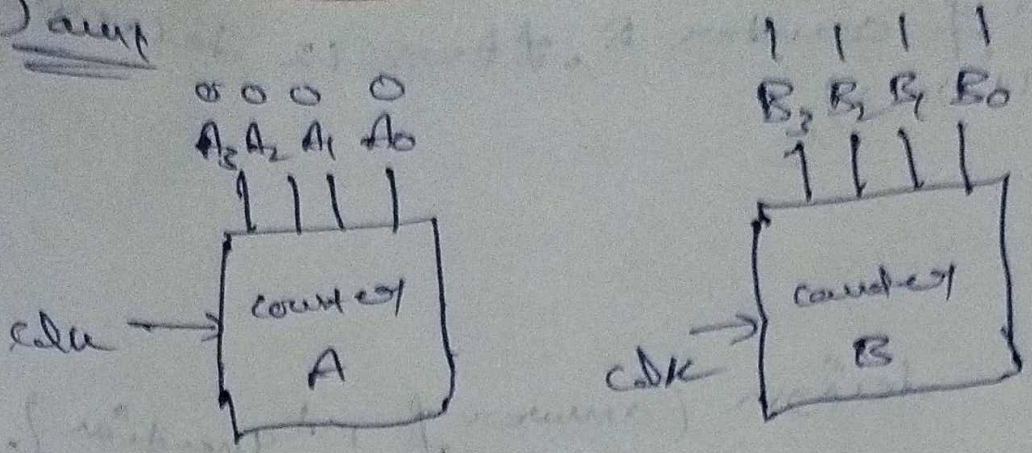
1) ans

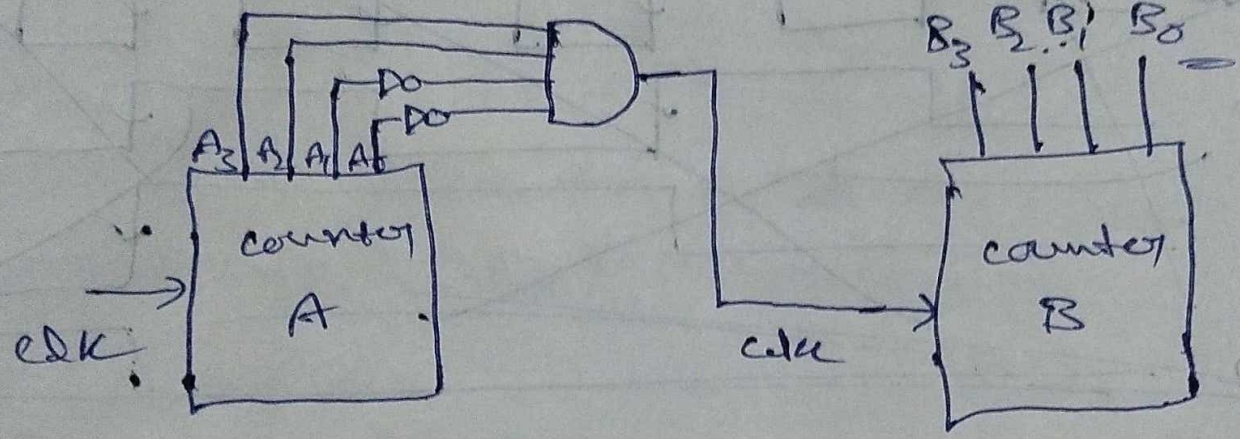


→ The counter 'A' is loaded with '0000' and it is a asynchronous up counter. and Counter B is a ~~a~~asynchronous down counter and loaded with '1111'.

→ The counter 'B' decrements when the output of counter 'A' is '12'.

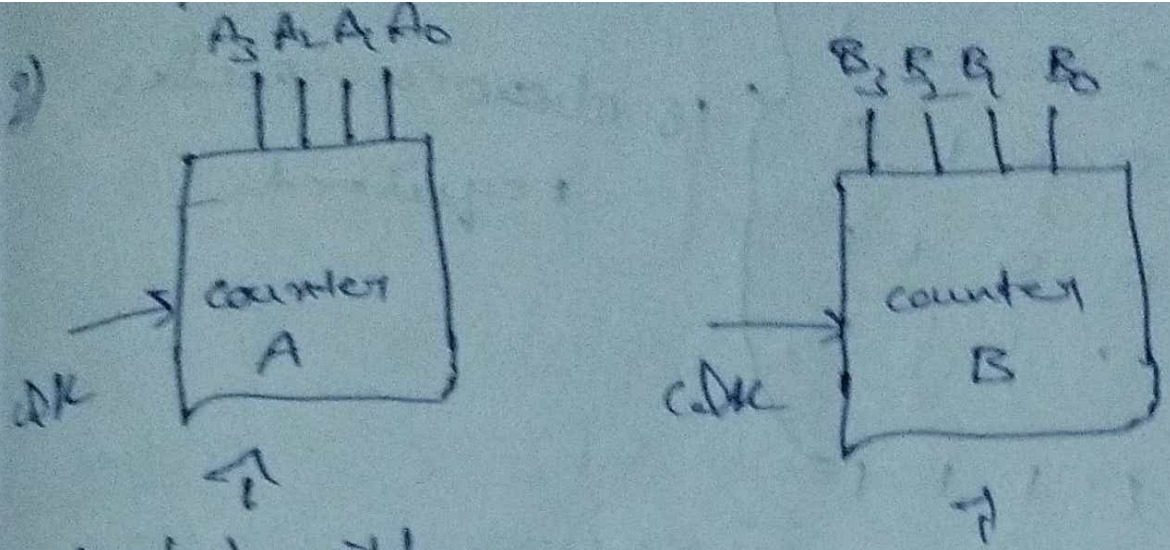
$A_3 A_2 A_1 A_0$

12 → 1 1 0 0



→ Here, clock of counter B is active when the output of counter A is '12'.

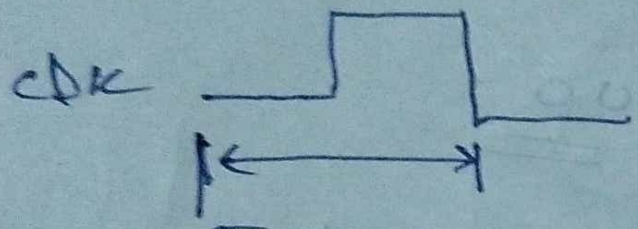
2)



Loaded with 0000 — Loaded with 1111

→ Frequency of clock source = 1 MHz.

$$T = \frac{1}{f} = \frac{1}{1 \times 10^6} = 1\,\mu sec$$



→ So, The decimal values at o/p's of both counters A & B at T = 0.2 ms is,

$$\text{no. of clock pulses} = \frac{0.2 \times 10^{-3}}{1 \times 10^{-6}} = 0.2 \times 10^3 = 200$$

→ In counter A,

Initial → 0 0 0 0
1st clk → 0 0 0 1
2nd clk → 0 0 1 0
⋮
15th clk → 1 1 1 1

→ 15 clock pulses required to complete all states

16th clk → 0 0 0 0
17th " → 0 0 0 1
18th " → 0 0 1 0
19th " → 0 0 1 1
⋮
31st → 1 1 1 1
32nd → 0 0 0 0

} 16 clock cycles required.

∴ $\frac{200 - 15}{16} = \frac{185}{16} = 11$ & remainder = 9.

192 clk → 0000
193 " → 0001
⋮
200 clk → 1000

∴ The o/p of counter A at 200th clk pulse is '1000' → $(8)_{10}$

For counter B:

→ The counter A completed 12 full circulation. So, counter B is decremented 12 times.

Initial → 1 1 1 1
1st → 1 1 1 0
2nd → 1 1 0 1
3rd → 1 1 0 0
4th → 1 0 1 1
5th → 1 0 1 0
6th → 1 0 0 1
7th → 1 0 0 0
⋮
12th → 0 0 1 1

⇒ The o/p of counter B after 12 decrements is 0011 → (3)$_{10}$

3) sol:-

From the design (answer of 1st question),
The counter B is connected to counter A.

⇒ The freq. of B_0 is:-

⇒ B_0 follows A_3 output and B_0 is the 5th bit of B.

$$\text{Freq}_{B_0} = \frac{\text{freq}_{in}}{2^5} = \frac{1MHz}{32} = 31.25\ KHz$$