Given:

2 counters.

A - asynchronous up counter.
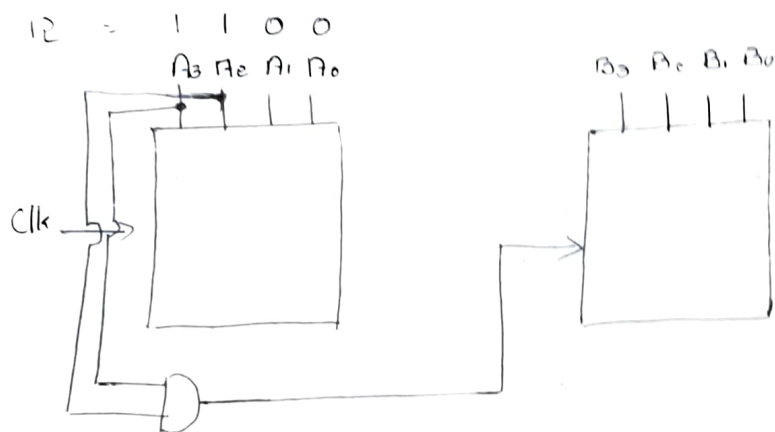
B - asynchronous down counter

@ T=0, A=0000   B 1111

@ T=0   Clk = 1MHz

1. Complete the design counter B decrements by 1
   value each time when decimal 12 appears
   @ o/p of counter A

   12 = 1 1 0 0
        A_3 A_2 A_1 A_0 B_3 B_2 B_1 B_0

   Clk

5. What is the decimal value at outputs of both counter A
   & counter B   @ T=0.2 ms?

   Given f = 1MHz

   Time period T = $\frac{1}{1\times10^6}$ = 1µs

   for 1 clk pulse   duration is 1µs

   ⇒ At the duration of 0.2 ms,
   no. of clk pulses = $\frac{0.2\times10^{-3}}{1\times10^{-6}}$ = 200 pulses

We know that. a counter A resets @ 16 pulses.

∴ After 200 pulses. the counter will be @ 200 % 16 = 8

For 8 clk pulses, • value of counter

$$A = (0111)_2 = (7)_{10}$$

For counter B,

no. of decrements $= \dfrac{200}{24} = 12$.

Therefore the remaining

bits $= 1111 - 1100$

$$= (0011)_2 = (3)_{10}$$

3. What is the frequency of Bo with respect to clk.

w.k.t , The counter has 4 bit i/p.

hence 4 f/f.

for, Each f/f $\oplus$ frequency of next bit is half the frequency of first bit.

• Therefore , 4 for LSB bit

$$frequency = \dfrac{1 \times 10^6}{24}$$

$$= \dfrac{1 \times 10^6}{16} = 62.5 kHz$$