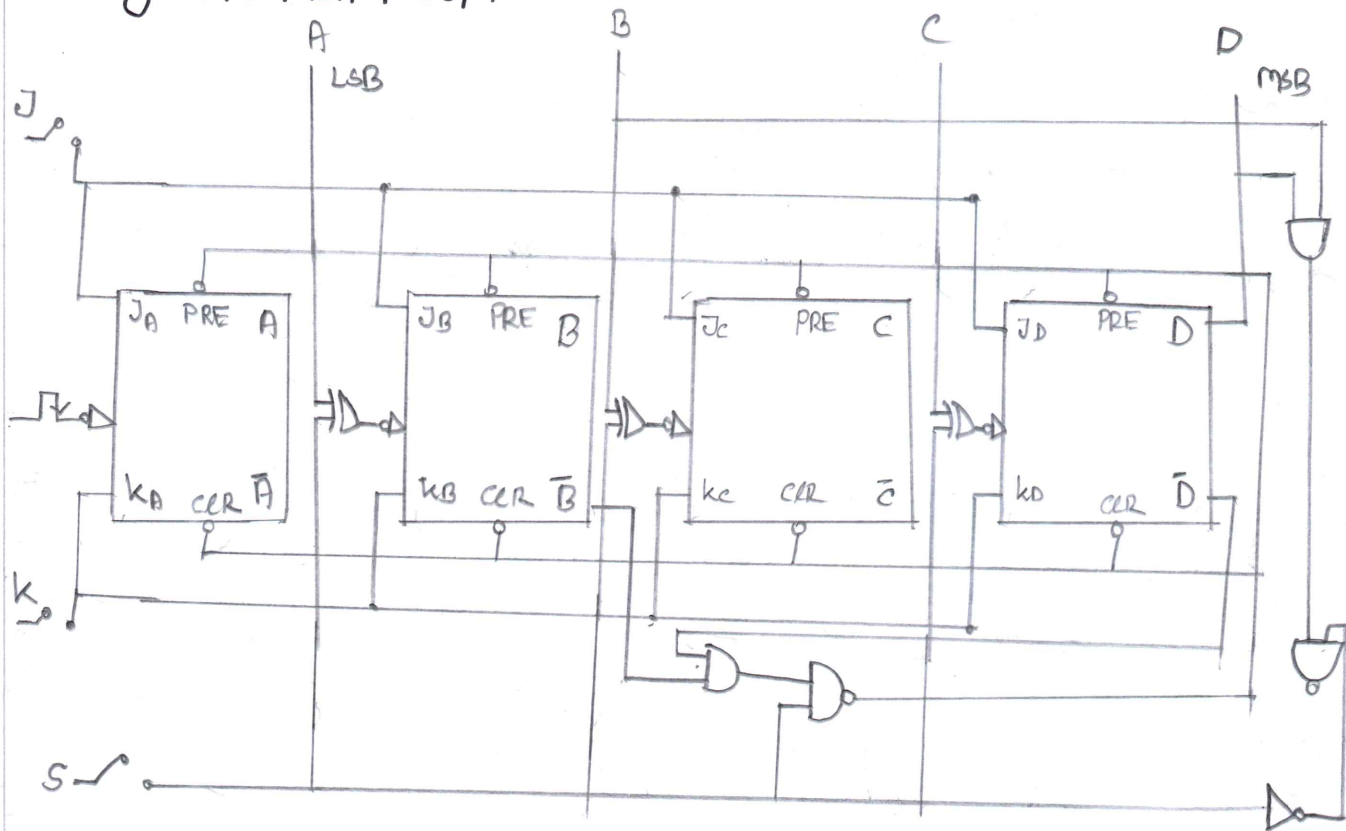


1) Design MOD 10 up/down Asynchronous Counter using JK FlipFlop.



Operation: When $S = 0$, For (0 to 9)

$PRE = 1, CLR = 0$

Normal clock operation ($PRE = 1, CLR = 1$)

For, 10

$PRE = 1, CLR = 0$

$A = B = C = D = 0$

This counts 0 to 9 so this is UP Counter

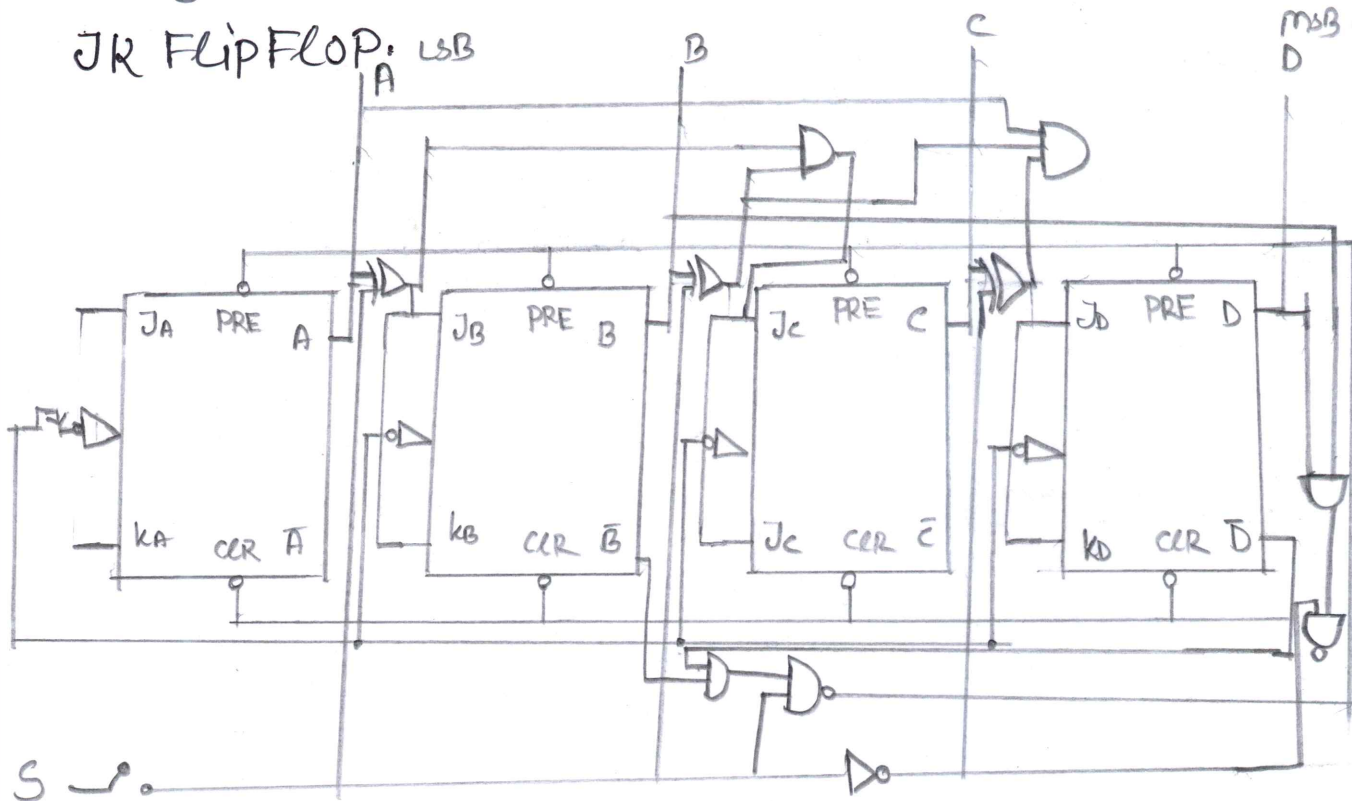
When $S = 1$, For

$A = B = C = D = 1$

$PRE = 0, CLR = 1$

This called Down Counter.

2) Design MOD10 UP/Down Synchronous Counter using JK FlipFlop. LSB



Operation:

When $S=0$, (0 to 9)

$PRE=1, CLR=0$ Normal clock operation
($PRE=1, CLR=1$)

$A=B=C=D=0$

This is a UP Counter

When $S=1$, (10)

$PRE=0, CLR=1$

$A=B=C=D=1$

This is a Down Counter.