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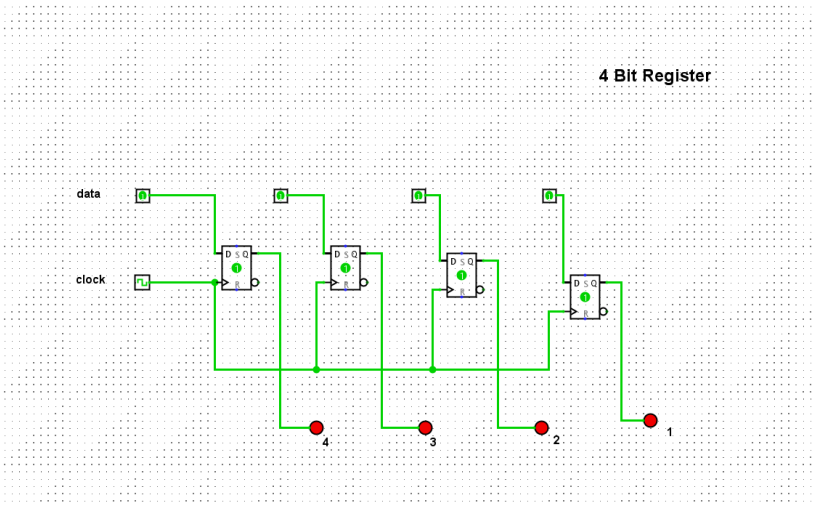
4 Bit Register :



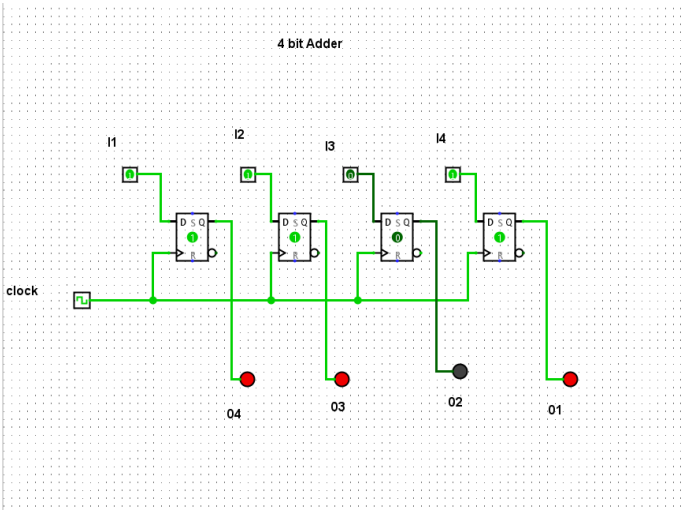
The table of 4bit Register :

0X	INPUT BINARY	OUTPUT BINARY
0	0000	0000
1	0001	0001
2	0010	0010
3	0011	0011
5	0101	0101
A	1010	1010
B	1011	1011
C	1100	1100
D	1101	1101
E	1110	1110
F	1111	1111

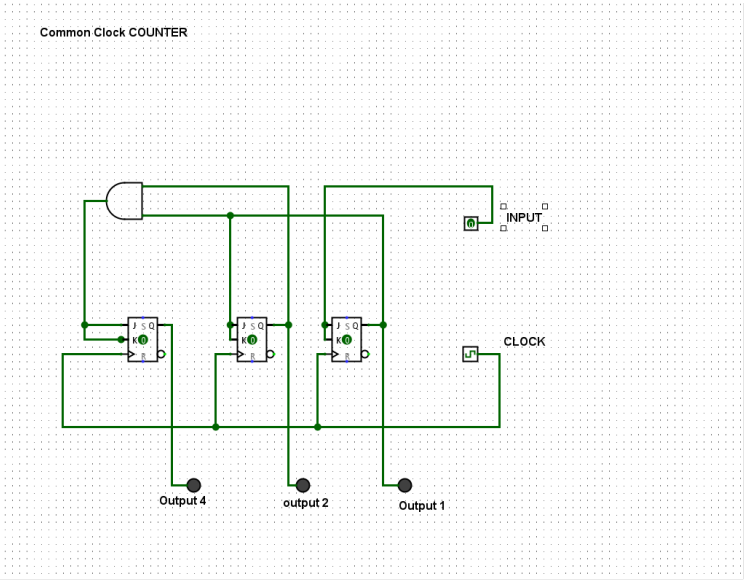
Name one crucial role (hardware) counters play in modern computing architectures
Counters are used to increment the value. This is essential in various computing architectures such as a Clock to tell the time, volume controls etc.
Describe in a few sentences how a ripple counter works.

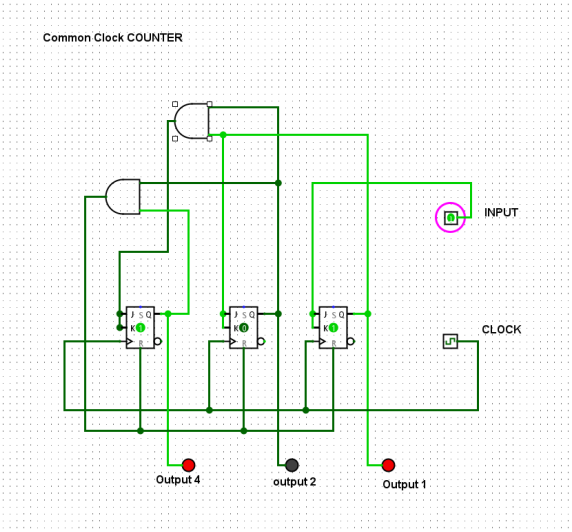
How does the "ripple" occur?
A ripple counter uses multiple Flip-Flops to store and shift the value to the next FlipFlop. It is asynchronous because it only uses a clock on the first F
afterwards, each input of the previous Flip-Flop acts as the clock. This allows the
inputs to be multiplied or divided by 2 depending on the motion of the clock pulse.

Count Down Ripple Counter :



Common Clock Counter :





Why is handling such things important?

Ensuring illegal states do not occur is essential because CPU's work with precision and even one momentary microsecond of a wrong input can destroy a program.
Common Clock Counter Counting 0 - 5 with Buffer and Hex Display.