EE2-10: T FLIP-FLOP AND A COUNTER CIRCUIT

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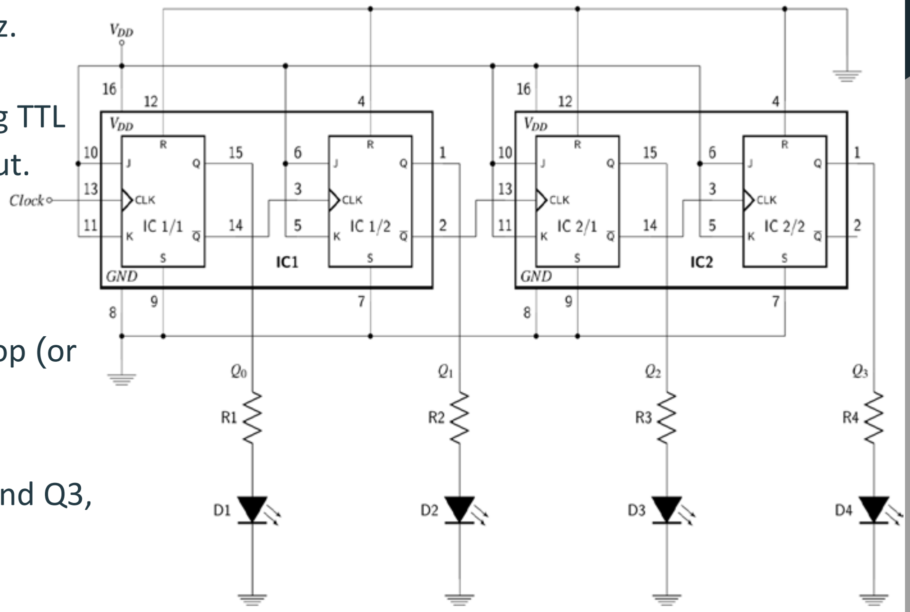
Four Bits Binary Ripple Counter

(P1) Set the clock signal which is a square wave with 5 Vp-p, 1 Hz.

★ Min volt is “0 V”, Max volt is “5 V.” This can be done using TTL output of the generator, **or** using offset of the main output.



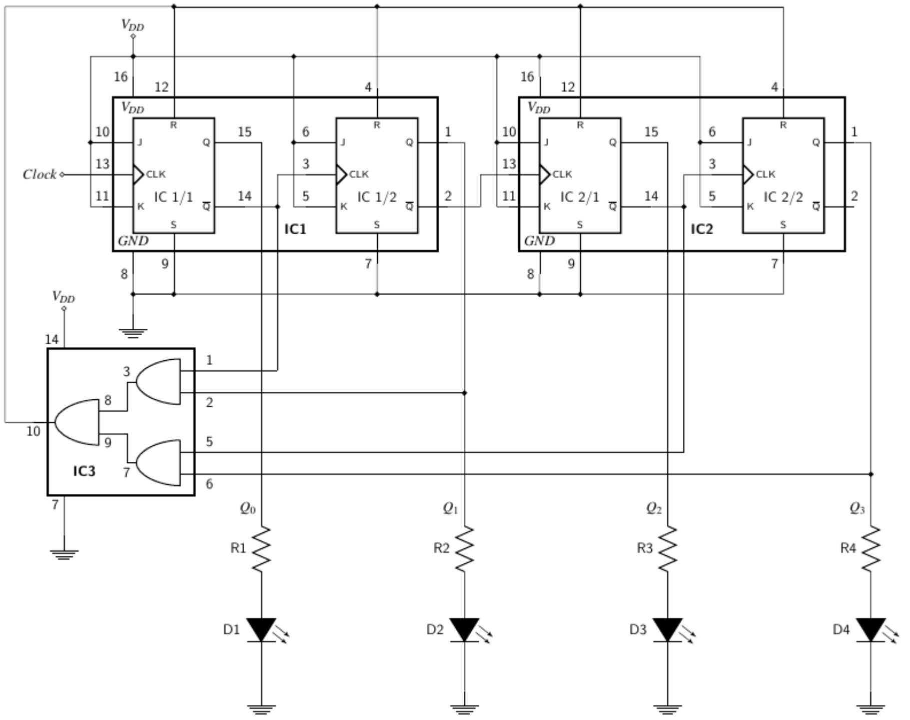
(P2) Construct a 4-bits ripple counter using JK Flip-flops.

- Make it simple by constructing one flip-flop by one flip-flop (or two by two).
- Test it at each step.
- Drive LEDs with their active output, namely Q0, Q1, Q2, and Q3, through current limit resistors.
- Be careful about the LED poraity, and the resistor value.

Mod-10 Ripple Counter

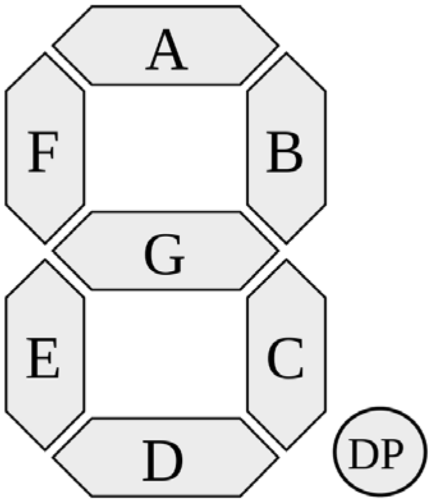
(P3) Modify the circuit to reset its count whenever the count reaches “10” or $(1010)_2$.

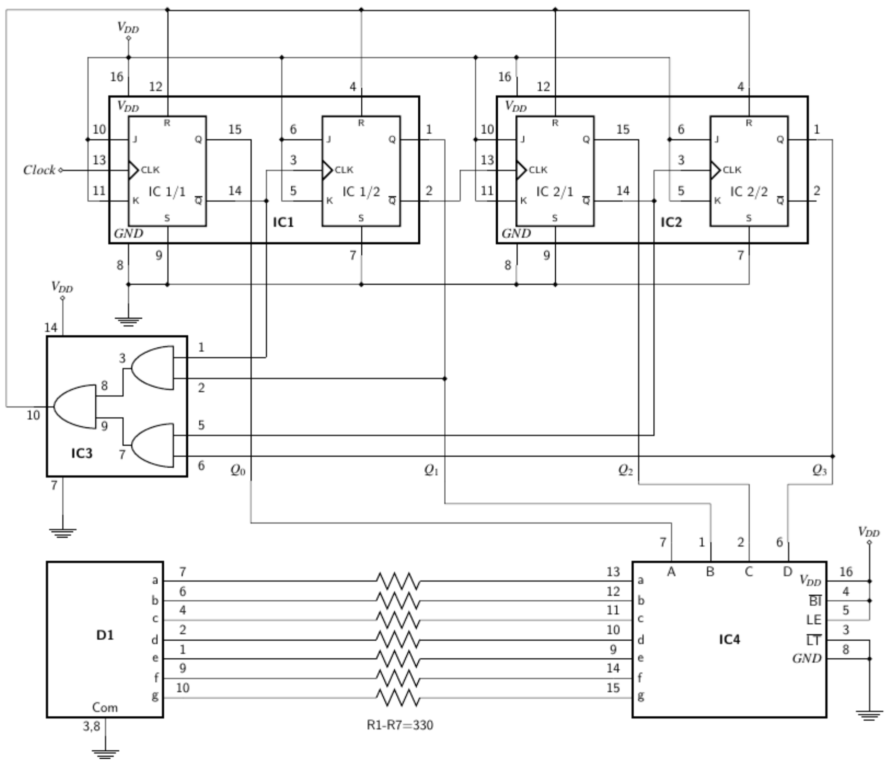
- Just add 3 AND gates.
- All AND gates are packed in one IC.
- All connections are not changed except the *Reset* pins of every flip-flop.
- Good planing make this step really fast.



Display counter result with 7-segments LEDs

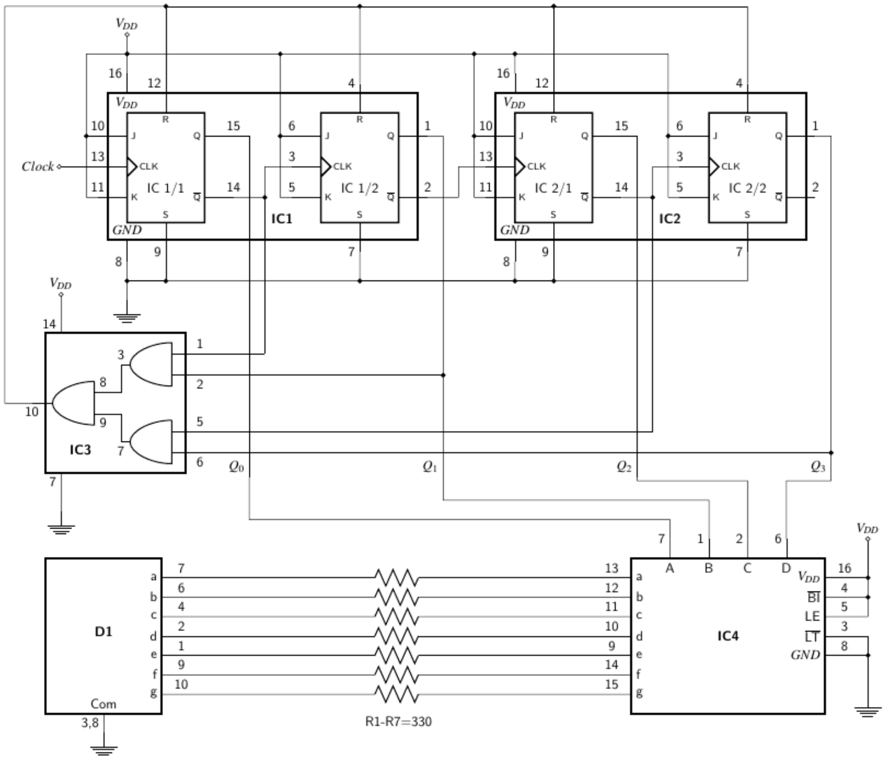
(P4) Add the display module to the circuit.
IC4 is a CD4511 and D1 is the 7-segment LEDs.
R1 – R7 are 330-Ω resistors.





Display counter result with 7-segment LEDs

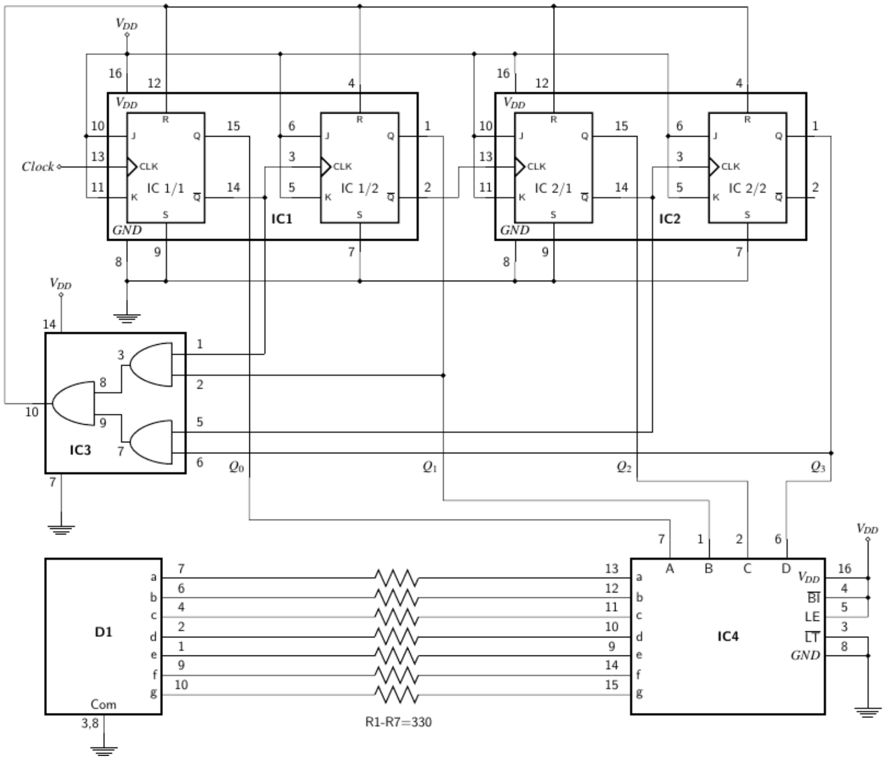
- You can keep your existing 4 LEDs if you like. It could help debuging you circuit, just in case.
- Conceptually, this consists of 2 circuits:
  - The counter
  - The decoder and display
  - You can debug these 2 circuits separately.
  - You can even construct these two circuits separately.
  - Output of the counter is the input of the decoder.



A word from instructor

- Circuits can be considered as a composition of many smaller circuits.
- Build things from small to large.
- Solve problems from easy to difficult.
- Make them modular so debuging will be a lot easier.

The circuit itself is an old fashion. You may not encounter such a circuit in your working life ever. <u>But it is an exercise for modular system which will never be outdated in the engineering world.</u>



Q&A