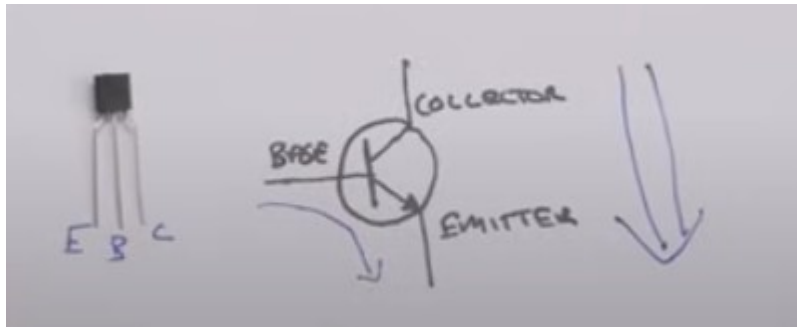


# Popquiz – Solutions (Sept 5, 2025)

## Review: Making logic gates from transistors ([Ben Eater, 2015](#))

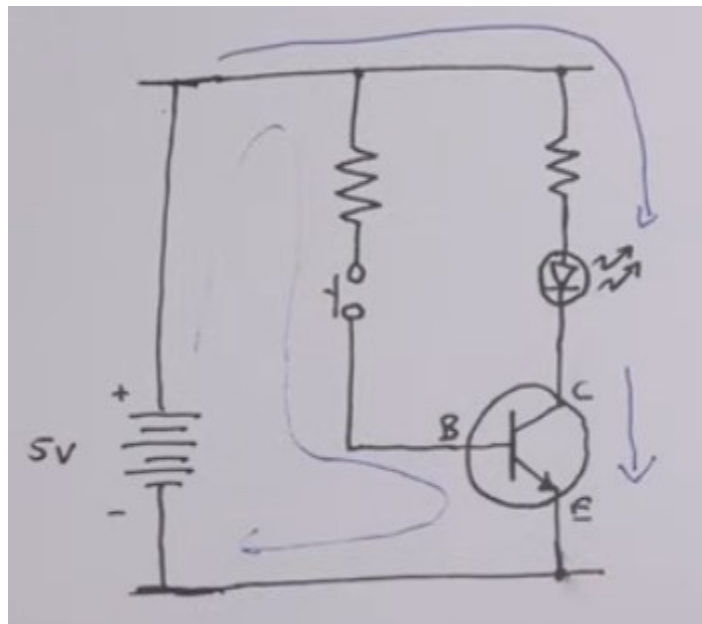
1. What are the three terminals of a transistor and what do they represent?

Emitter, Base, Collector. The base controls current flow between collector and emitter.



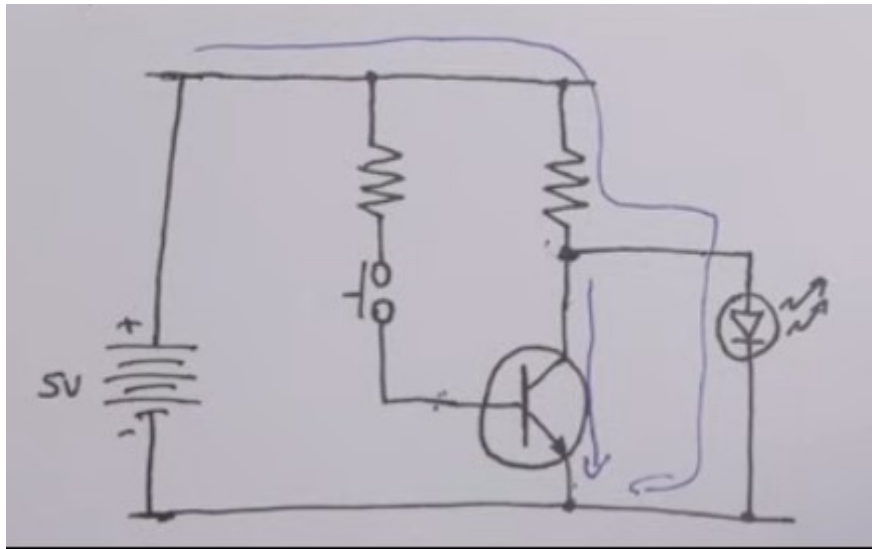
2. What happens in the LED circuit when current flows from the base to the emitter?

The transistor switches on and allows a larger current from collector to emitter, lighting the LED.



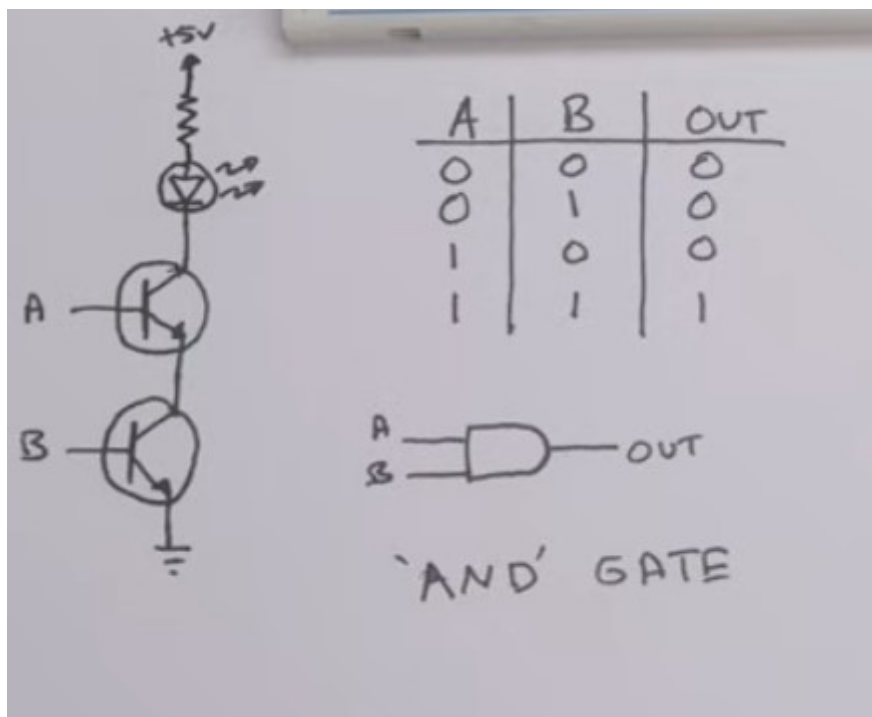
3. Which logic gate does a single transistor implement when it inverts the input?

A NOT gate (inverter): input ON → output OFF, input OFF → output ON.



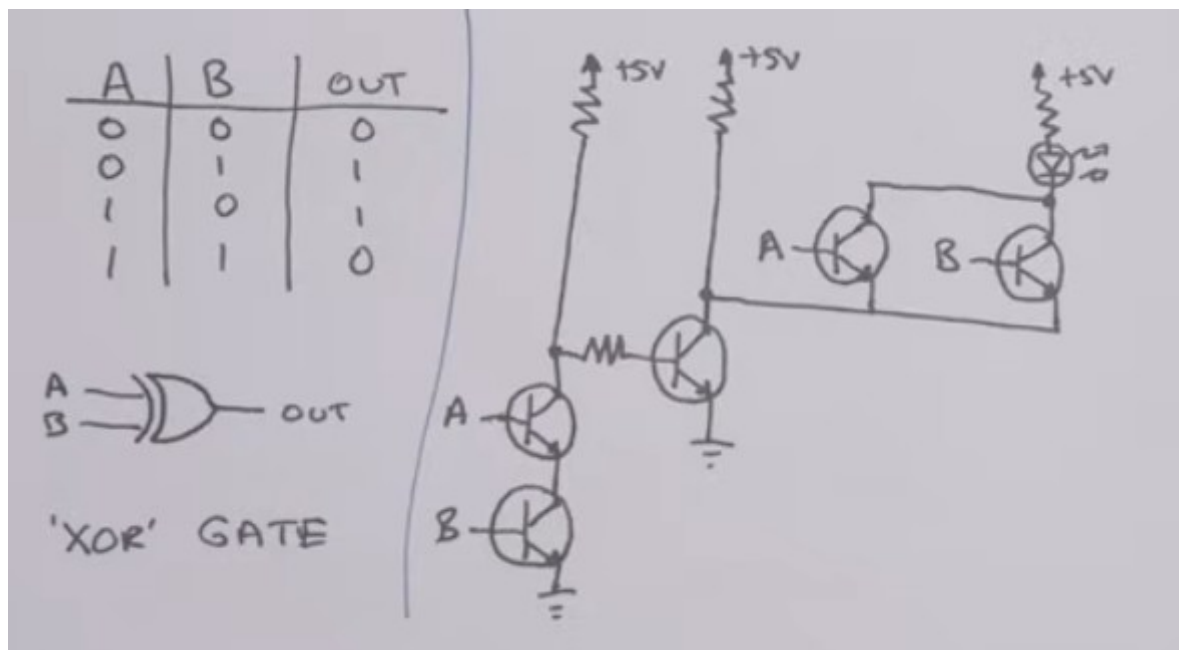
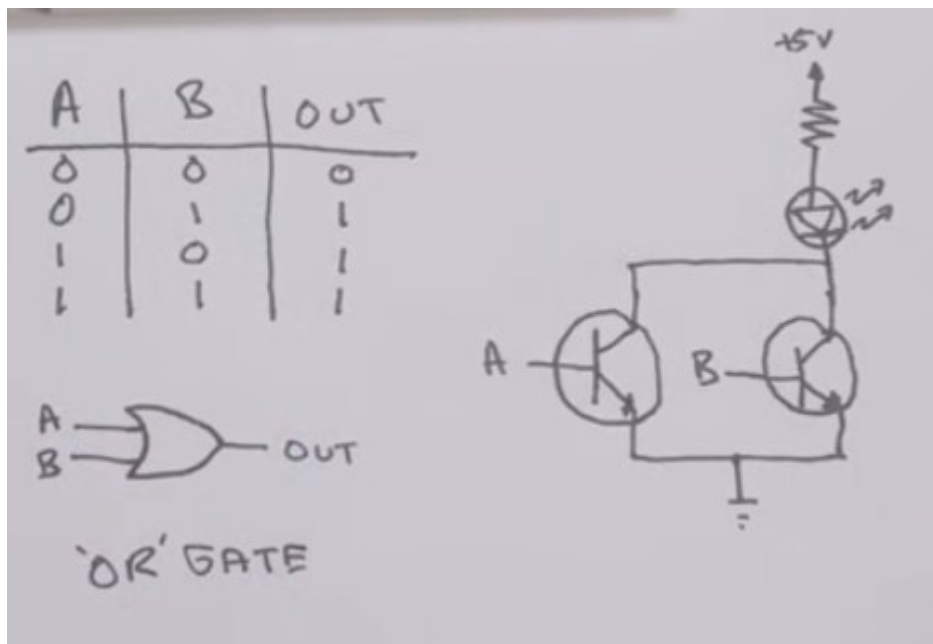
4. How is an AND gate built with two transistors?

The transistors are placed in series. Current flows and the LED turns on only if both are conducting (both inputs ON).



5. What is the difference between an OR gate and an XOR gate?

OR: output ON if one or both inputs are ON. XOR: output ON only if exactly one input is ON (off when both are ON).



## **Review: How are Microchips made? ([Branch Education, YouTube 2024](#))**

1. What is the approximate number of steps required to manufacture a modern CPU chip?  
Around 940 steps, taking about 3 months.
2. What type of transistor structure is commonly used in today's CPUs, and how small are they?  
FinFET transistors, with dimensions on the order of tens of nanometers (e.g., 36×6×52 nm).
3. What are the six main categories of fabrication tools used in a semiconductor fab?  
Mask-making, deposition, etching/planarization, ion implantation, cleaning, and metrology/inspection.
4. How does chip “binning” affect the product lines (e.g., i9, i7, i5)?  
Chips with defects are categorized based on functional cores and features, sold under different product tiers.
5. Why is photolithography considered one of the most important steps in chip fabrication?  
It transfers nanoscopic circuit patterns from photomasks onto wafers, enabling billions of identical transistors and wires.