EE2001 - Digital systems lab
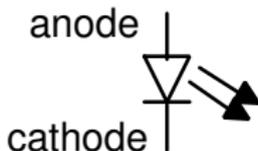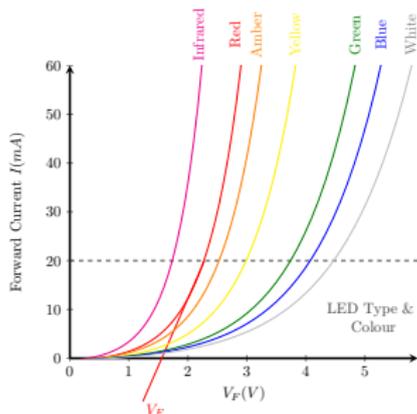
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Light emitting diodes

1. Displays - Indicating ON/OFF to very complex displays
2. Useful for testing
3. Seven segment displays - used to display digits.

Basically, it is a diode. Forward direction (anode positive with respect to the cathode) - current flows and it emits light.
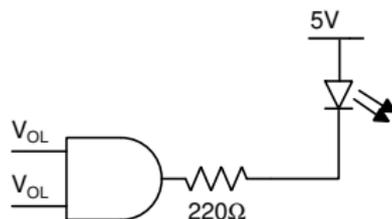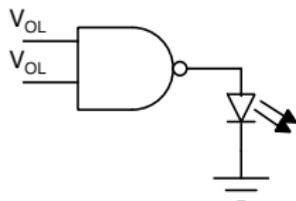

anode

cathode

The shorter lead is the cathode.

Forward voltage of an LED is between 1.8V - 3V. Forward current between 10mA to 30mA (most commonly between 12 and 20mA)

Connecting LEDs to TTL outputs

The LED should glow if $F(A, B) = 1$. Example $F(A, B) = \overline{AB}$

- ▶ When output is high, a TTL gate can source $400\mu A$. It can sink at least 8mA; more if output is allowed to rise.
- ▶ Implement $\bar{F}$ and connect the LED between V_{CC} and the output.
- ▶ Connect an inverter at the output before connecting the LED.

Seven segment displays

Common anode or common cathode - We will be using common anode. It has seven LEDs, with anodes connected together.
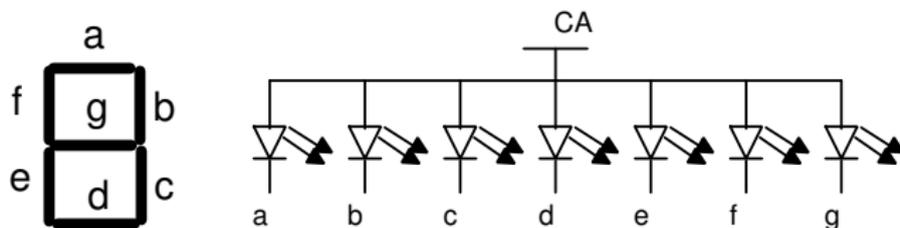
Typical operating point of each segment LED varies from 1.6V to 2V at 20mA operating current. The common anode is connected to V_{CC}. Connect a current-limiting resistor between the cathode and output pin of the TTL gate.

7447 - BCD to seven segment decoder and driver
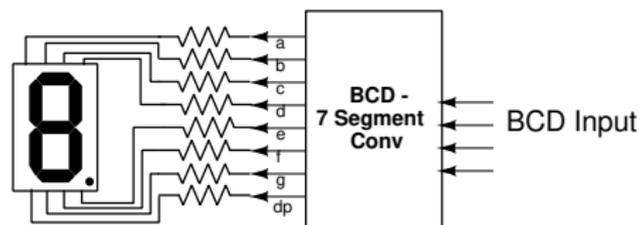
The resistors connected between 7447 and the seven segment display should be chosen so that the current is less than 20mA at nominal operating point.

Parity Check

- ▶ A parity bit is added to message bits for error detection in transmitted messages
- ▶ Even parity: The number of ones in the message is counted. If the number is odd, the parity bit is '1' so that the total number of 1s in the transmitted string (message+parity) is even.
- ▶ In the receiving side, if you get an odd number of ones, it indicates an error.

Experiment 5

- ▶ Make a list of components you have and note down their function.
- ▶ Design a 4 bit (3 message bits + 1 parity bit) even parity check circuit. At the output, connect an LED so that it glows if there is an error.
- ▶ Design a circuit to convert a 4-bit binary number to its BCD representation. The output should be displayed using two seven segment displays.
- ▶ First design the circuit using any of the components you have and get it checked by your TA.
- ▶ Download the relevant data sheets and read them before wiring. Read up on ripple blanking and implement it.