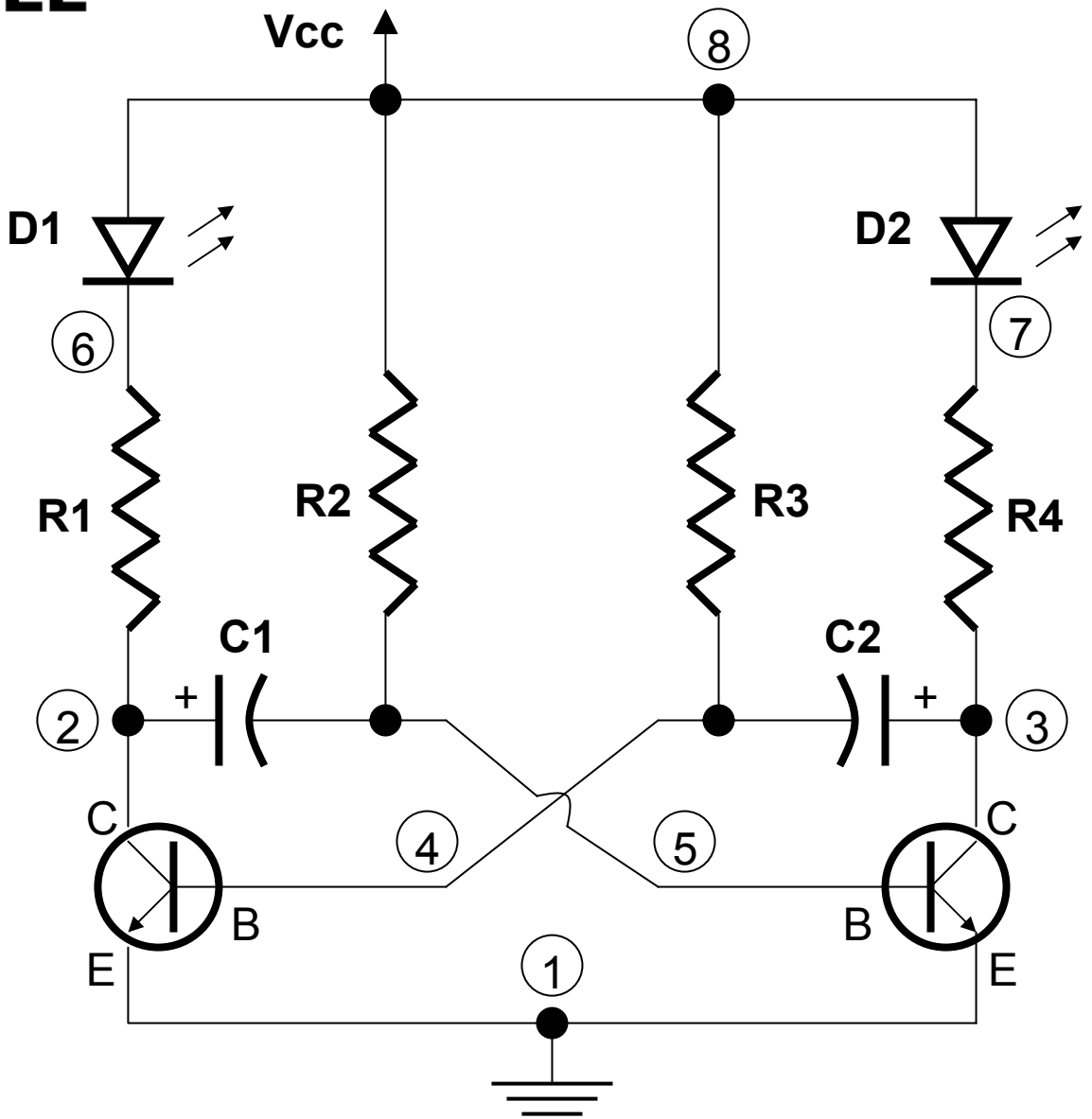
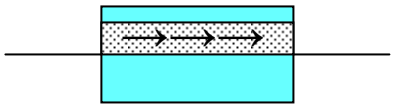
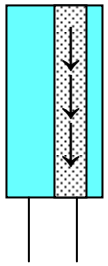



C1, C2: 330 µF
D1, D2: LED
R1, R4: 100 Ω
R2, R3: 10-100K
Q1, Q2: NPN
Vcc = 3V

Resistors resist the flow of electric current.

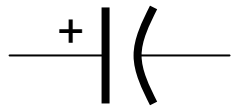
R1, R2, R3, R4

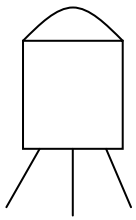


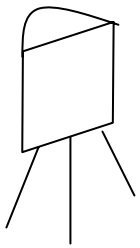


Capacitors store electric charge.

C1, C2

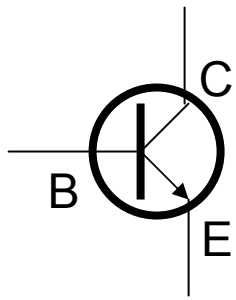


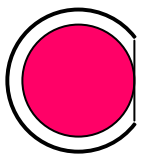





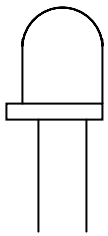
Transistors control the flow of electric current.

Q1, Q2



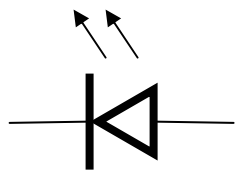



top view

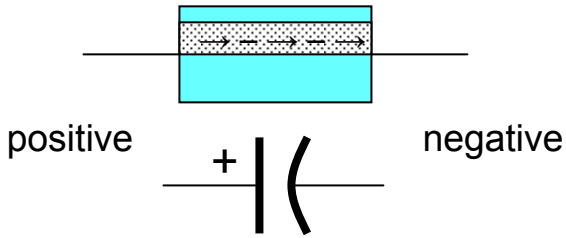


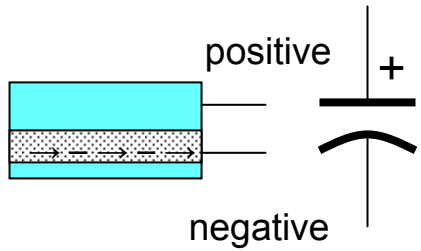
Diodes pass electric current only in one direction.

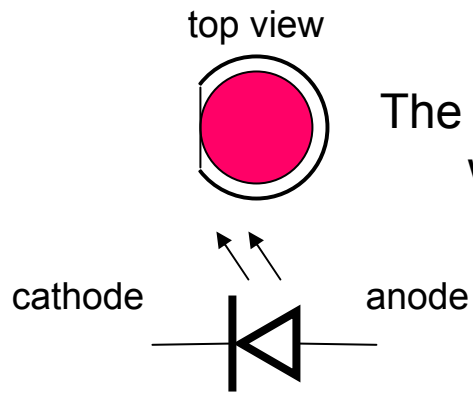
D1, D2



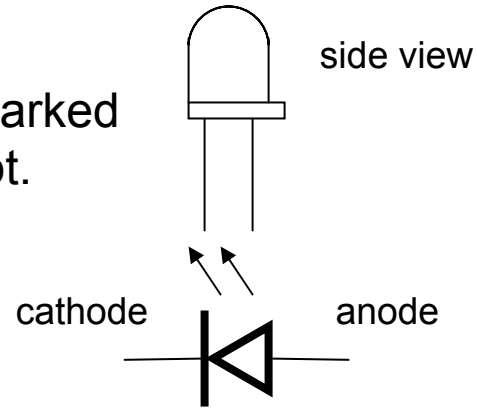
The negative lead of an electrolytic capacitor is usually marked.

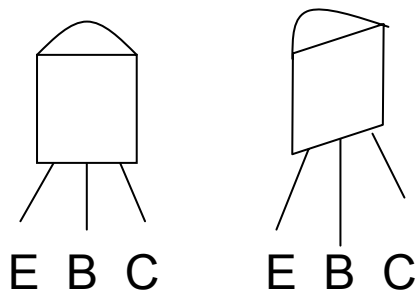


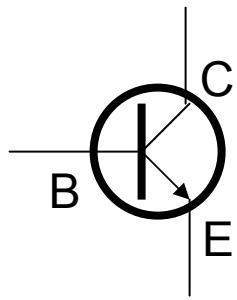




The cathode of a diode is marked with a band or a flat spot.

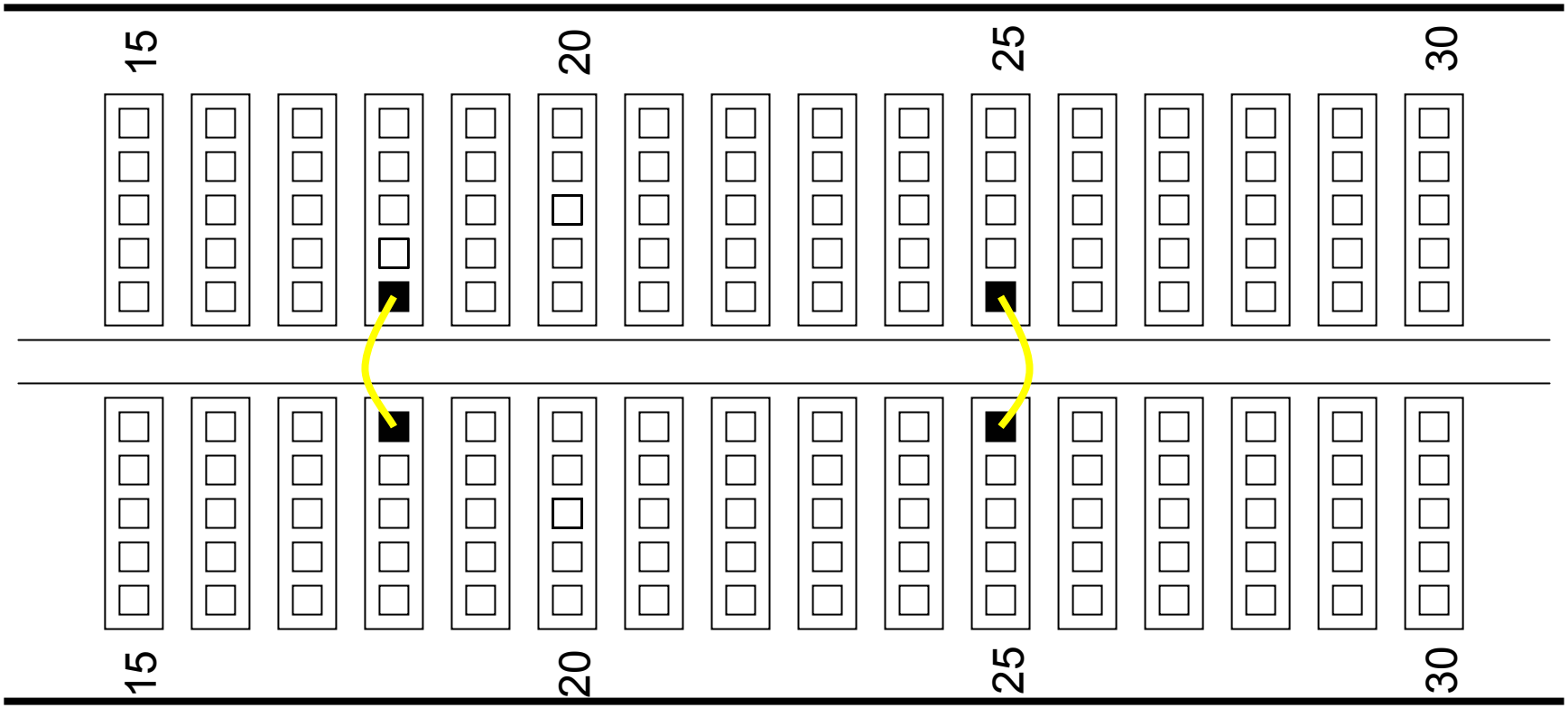


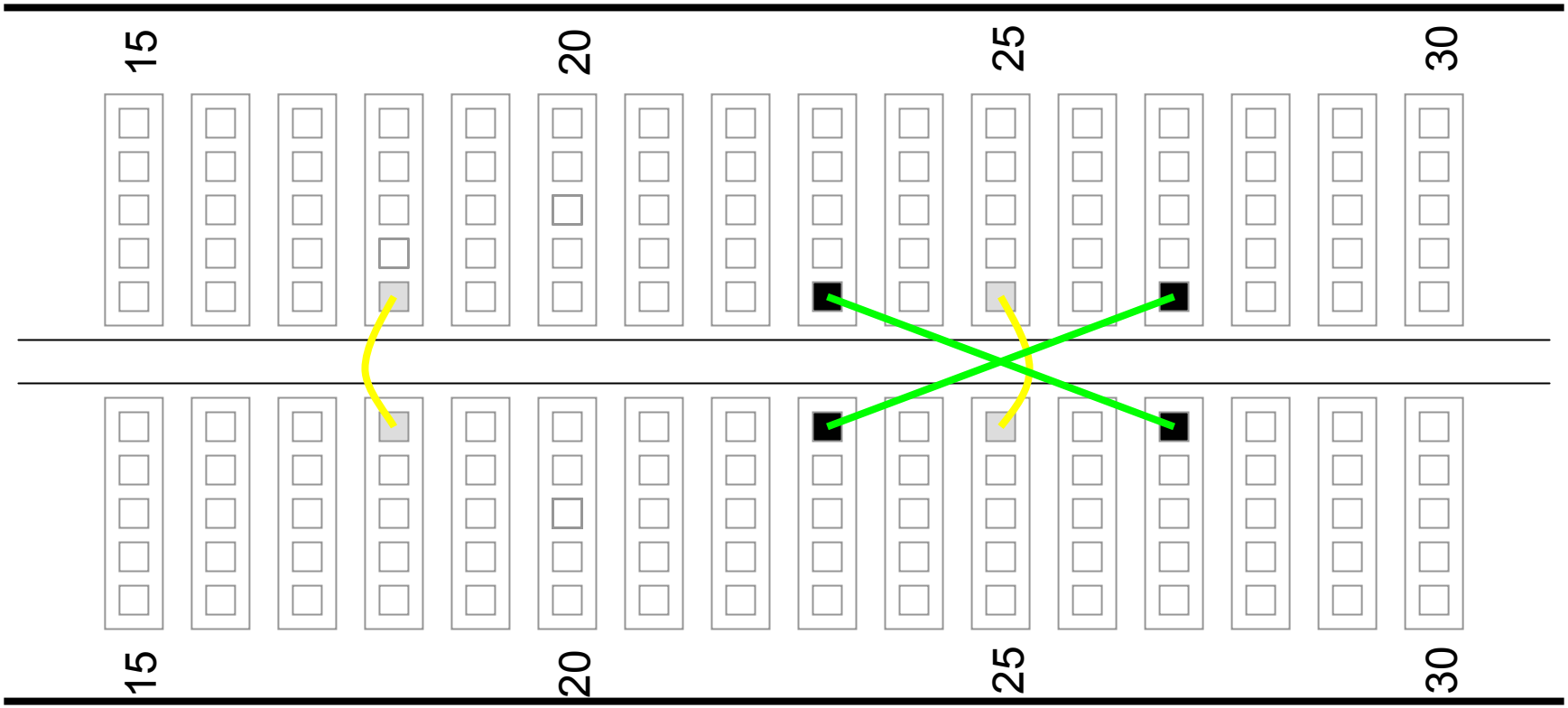

Transistors have three leads: emitter (E), base (B), and collector (C).



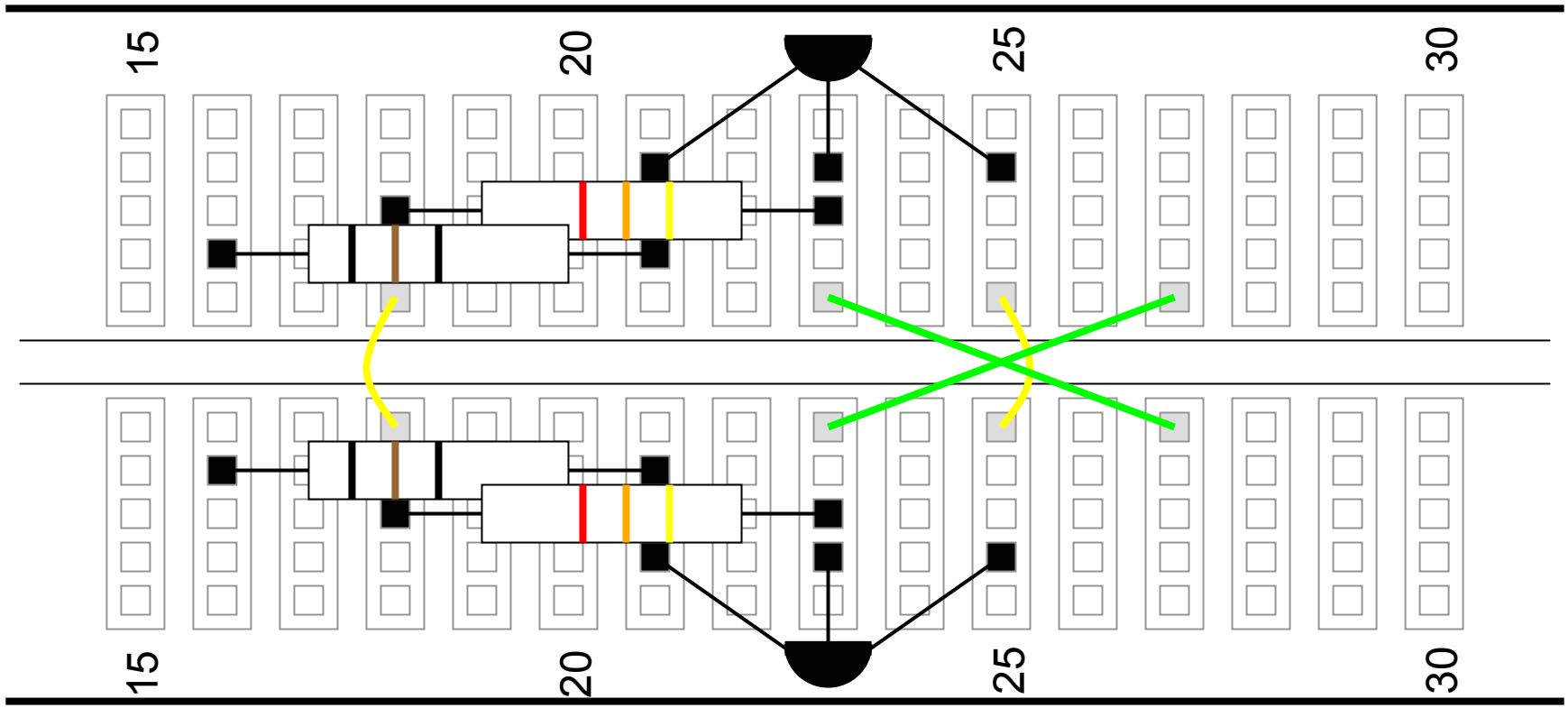
# Project A: flip-flop flasher




A1 connect yellow jumper wires across the channel at rows 18 and 25

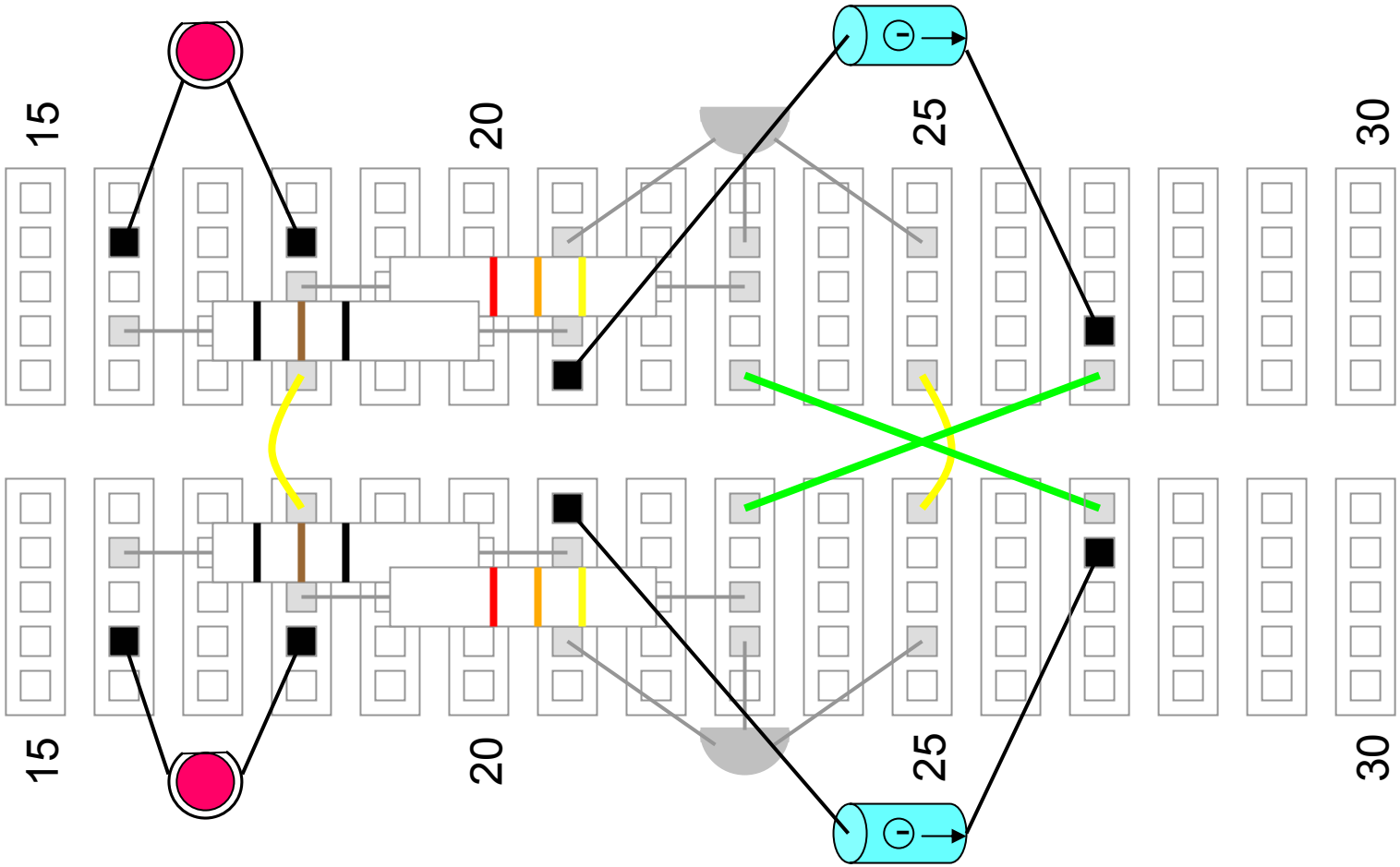



A2 connect green jumper wires across channel from row 23 to row 27



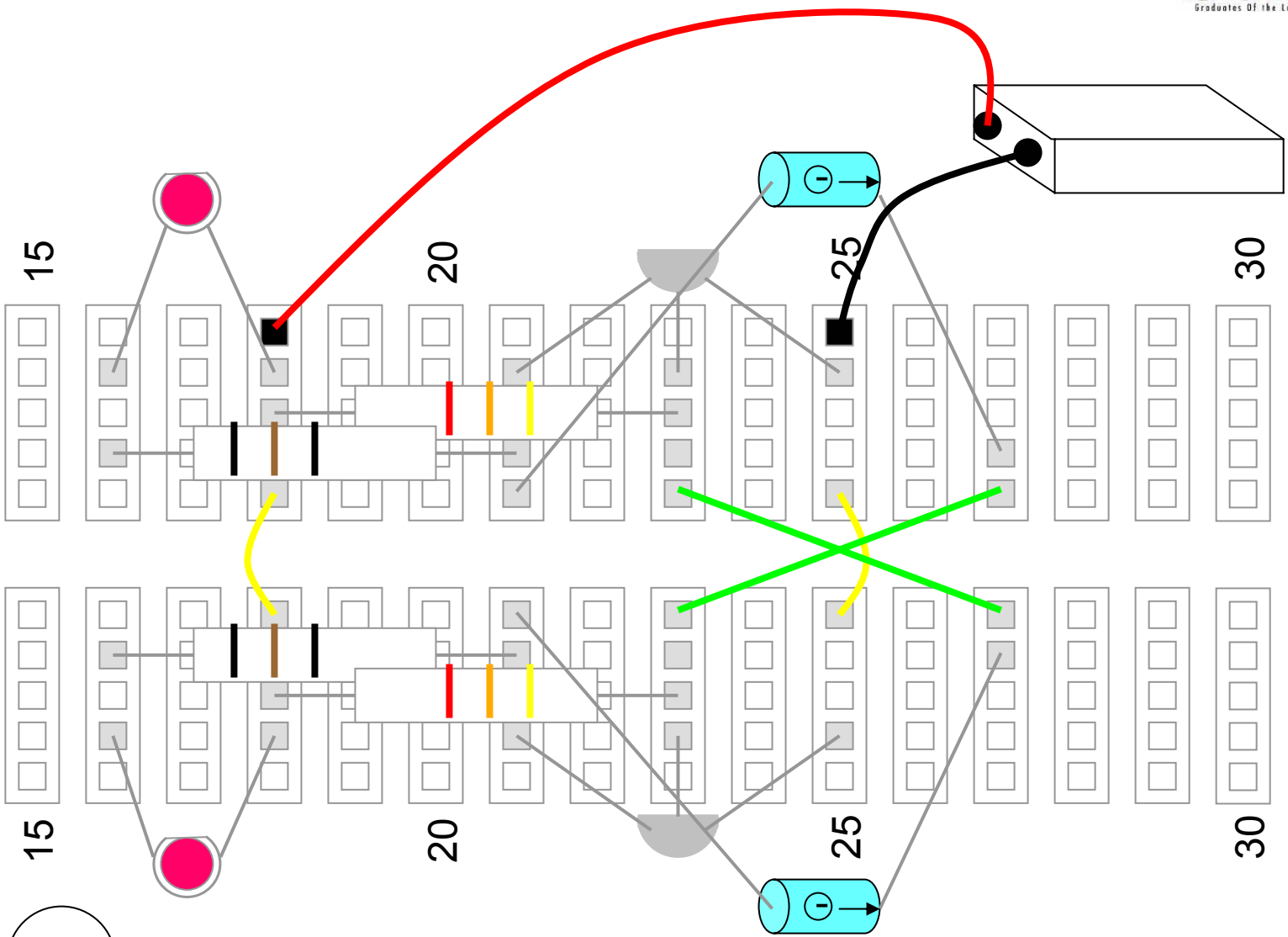

A3

add transistors at rows 21, 23, and 25 (FLAT SIDE UP!)
add black-brown resistors at rows 16 and 21
add resistors with red, orange, or yellow band at rows 18 and 23




A4

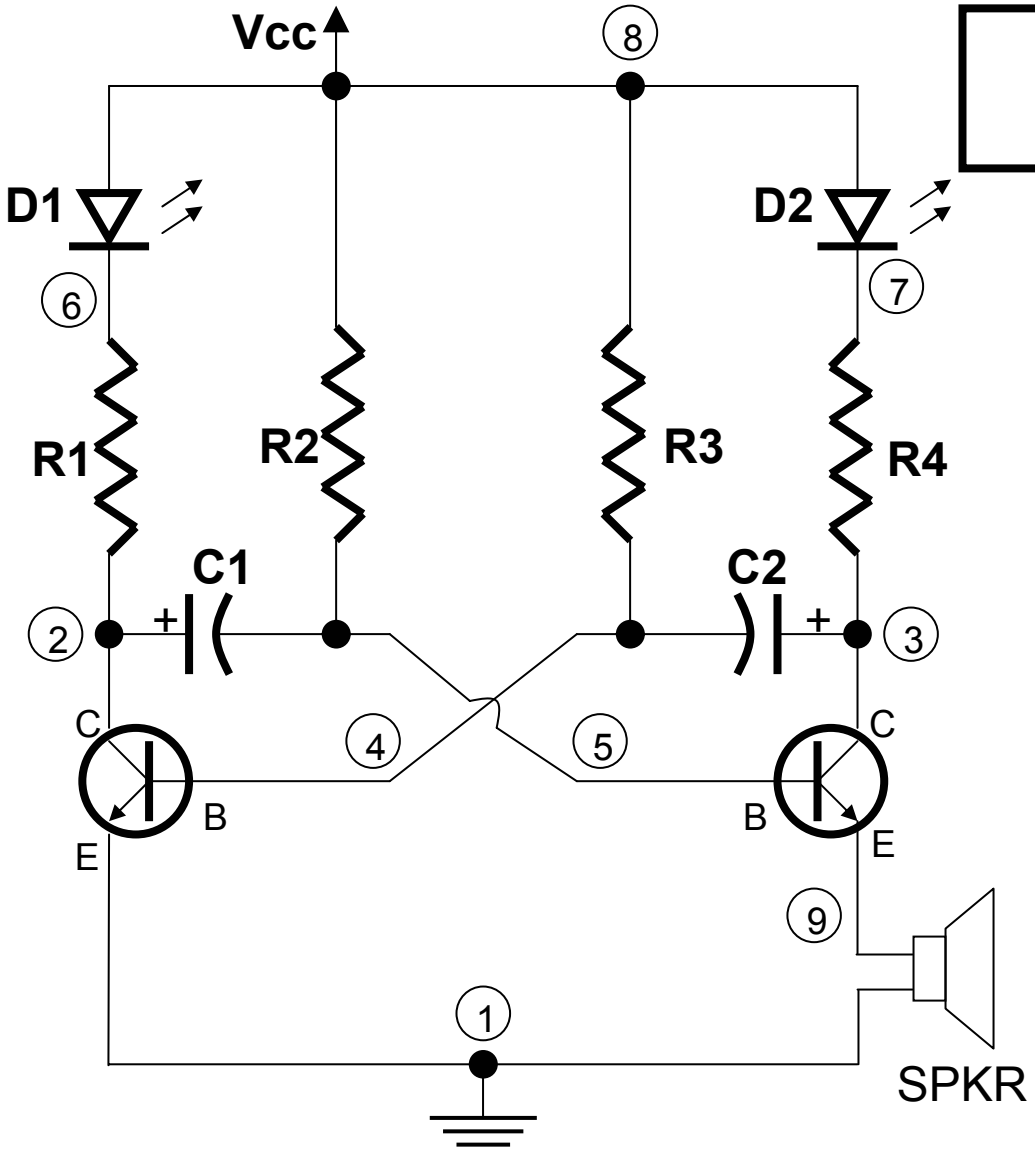
add capacitors at rows 21 and 27
add LEDs at rows 16 and 18 (FLAT SIDE UP!)



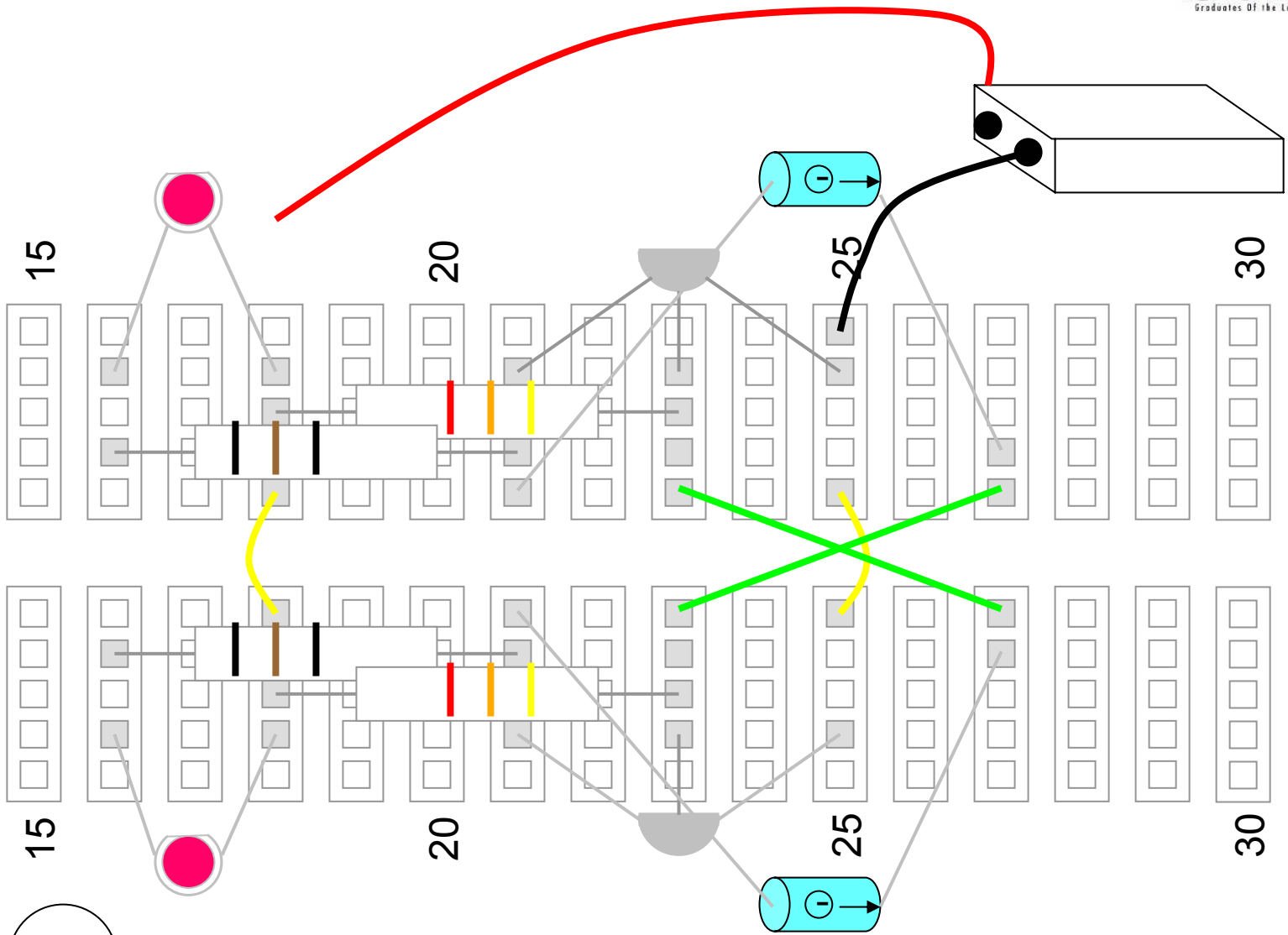

A5

last step: connect battery
black wire to row 25, red wire to row 18

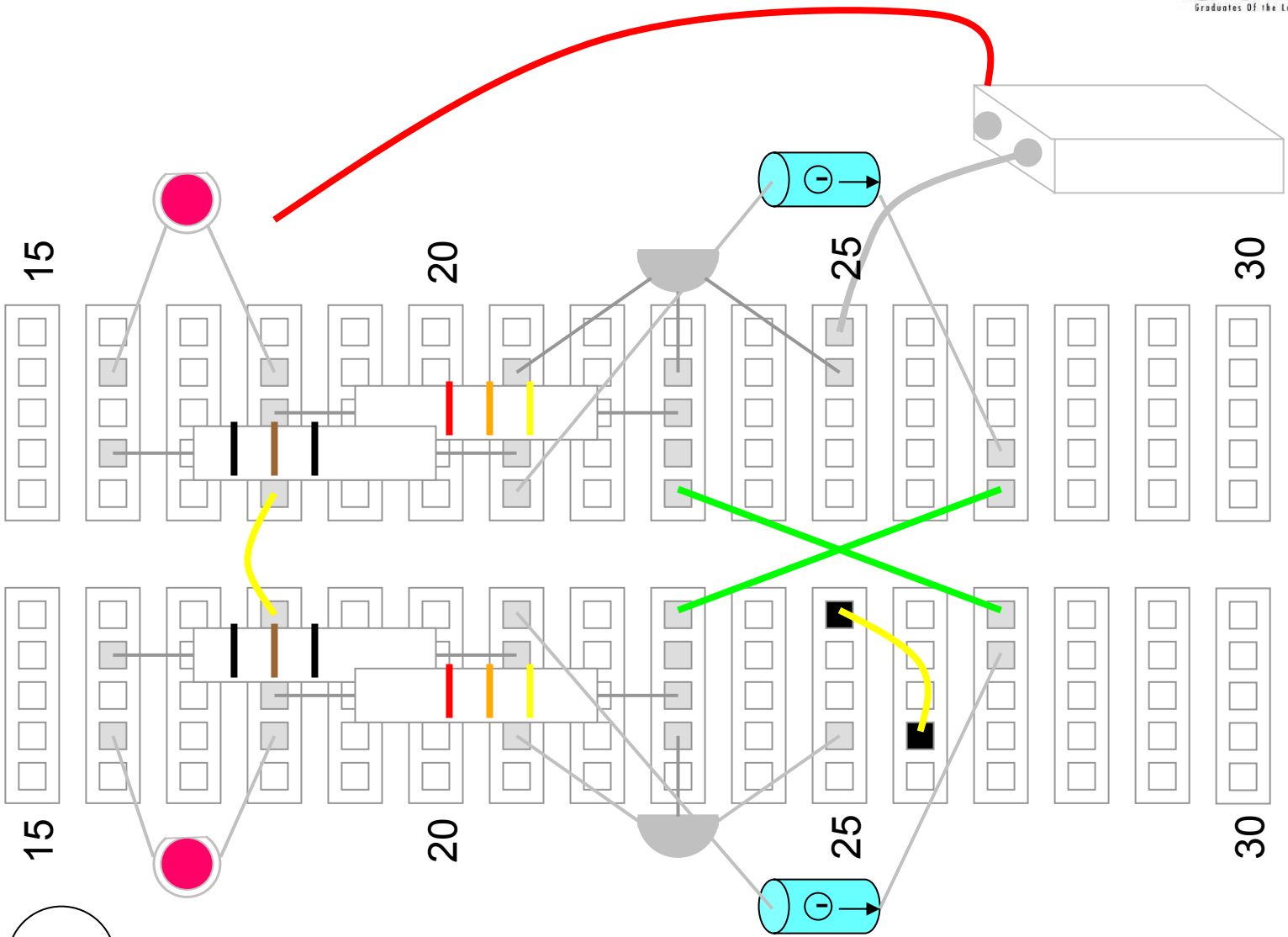
# Project B: flip-flop clicker



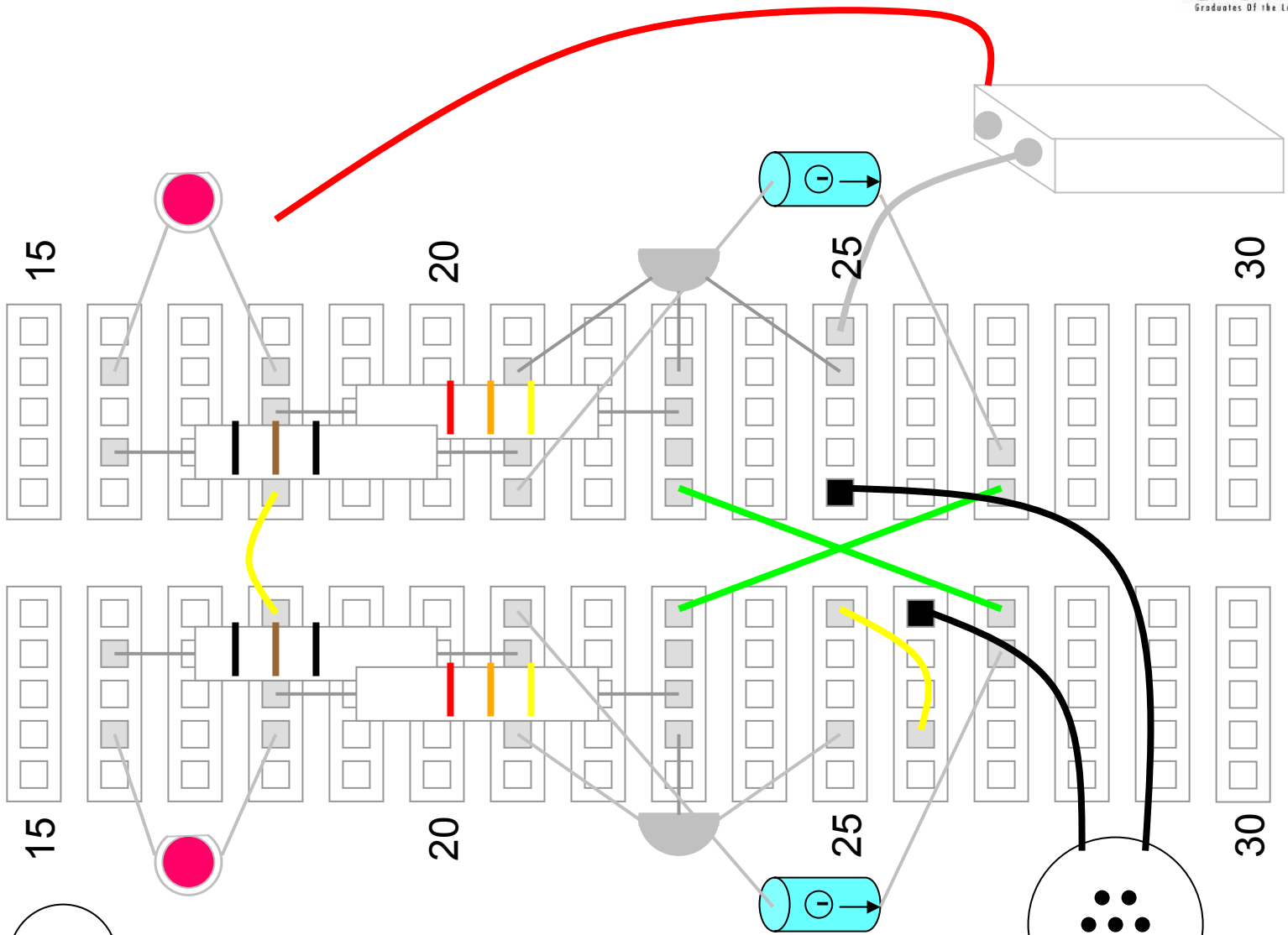

C1, C2: 330 µF
D1, D2: LED
R1, R4: 100 Ω
R2, R3: 10-100K
Q1, Q2: NPN
Vcc = 3V



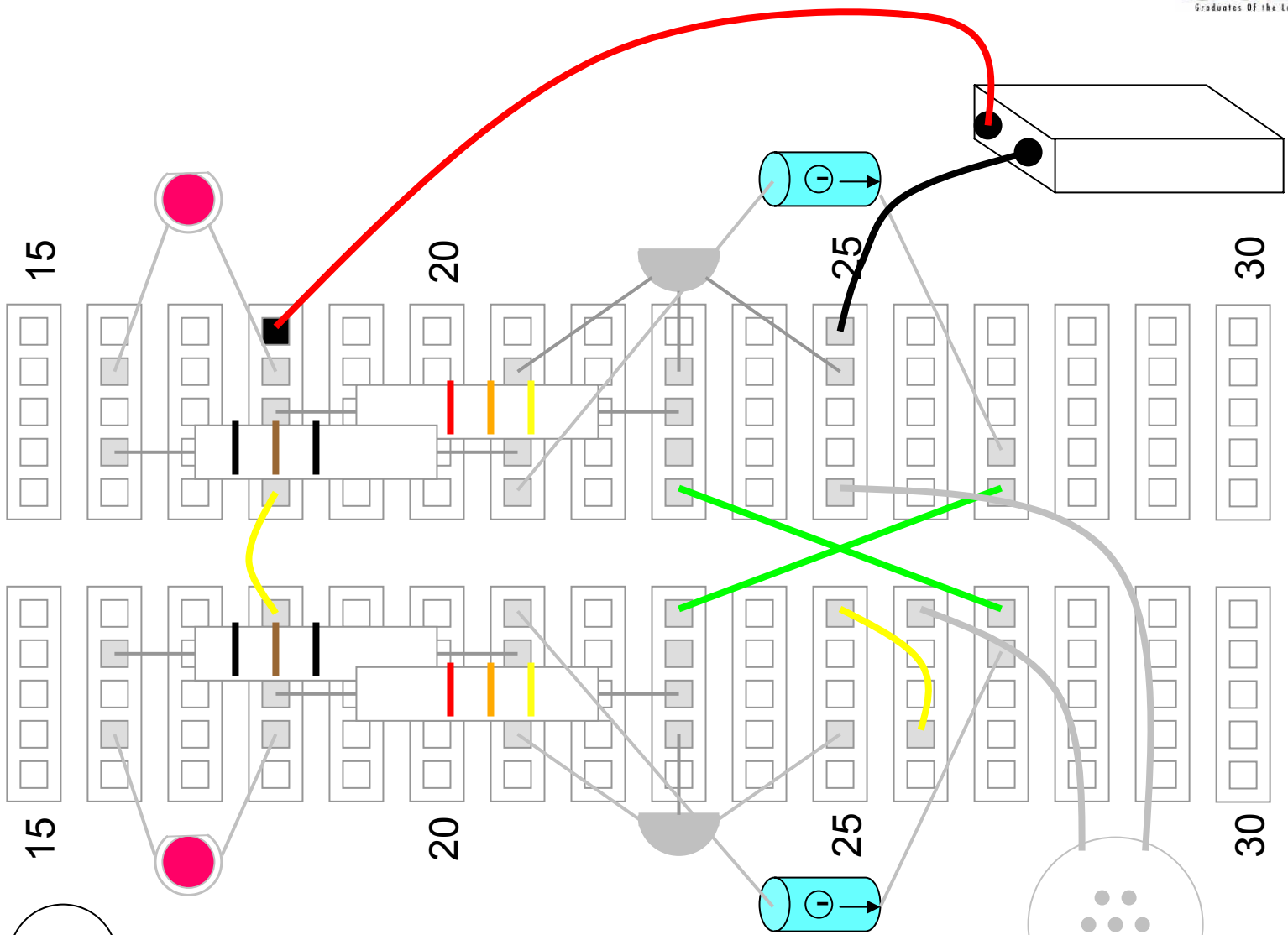

B1 disconnect red wire of battery




B2 remove yellow jumper wire at row 25. Bend it into a tight U shape, and connect it between rows 25 and 26 (NOT ACROSS CHANNEL)

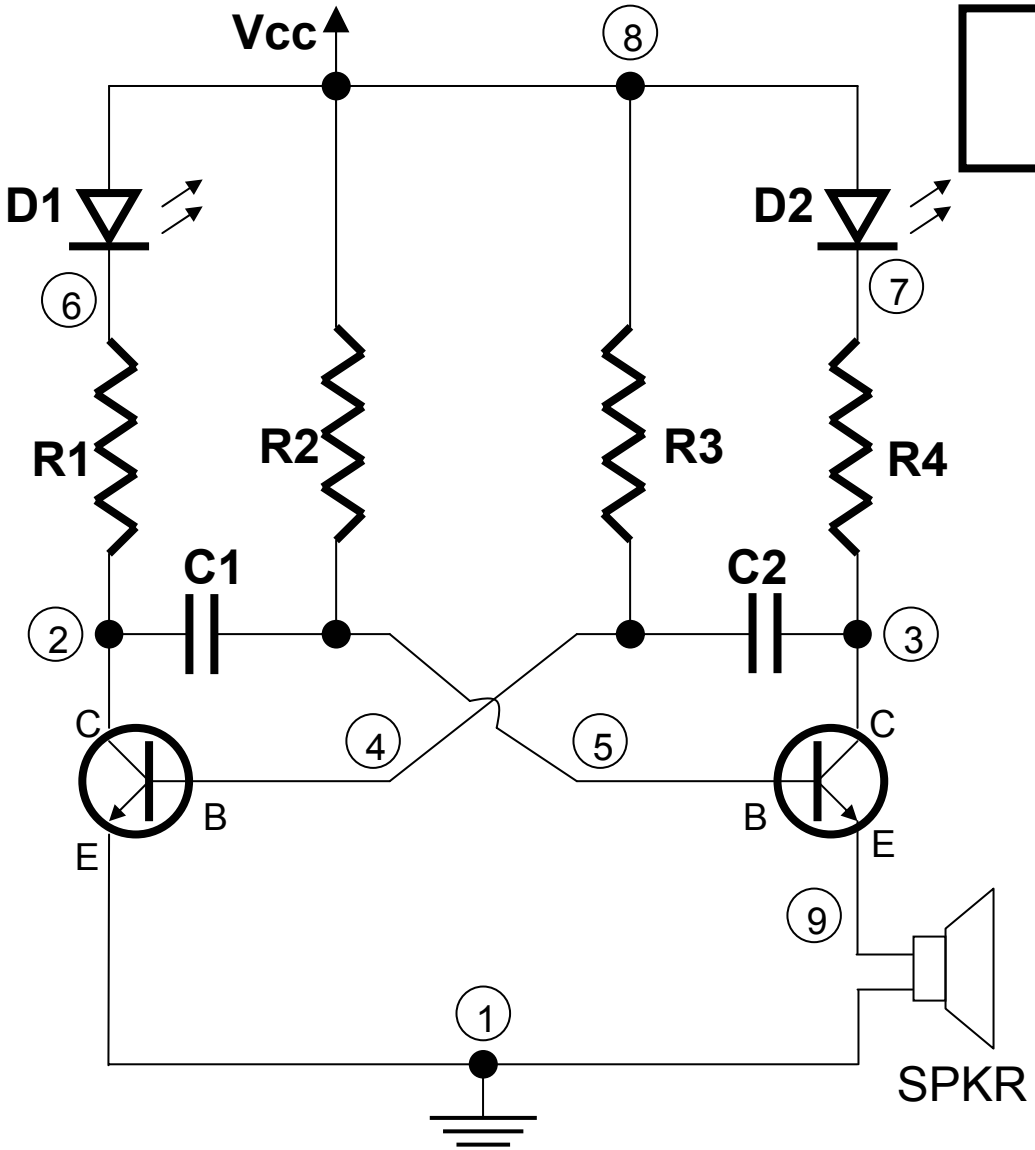



B3 connect speaker at row 26 where the yellow wire is, and at row 25 on the other side of the channel

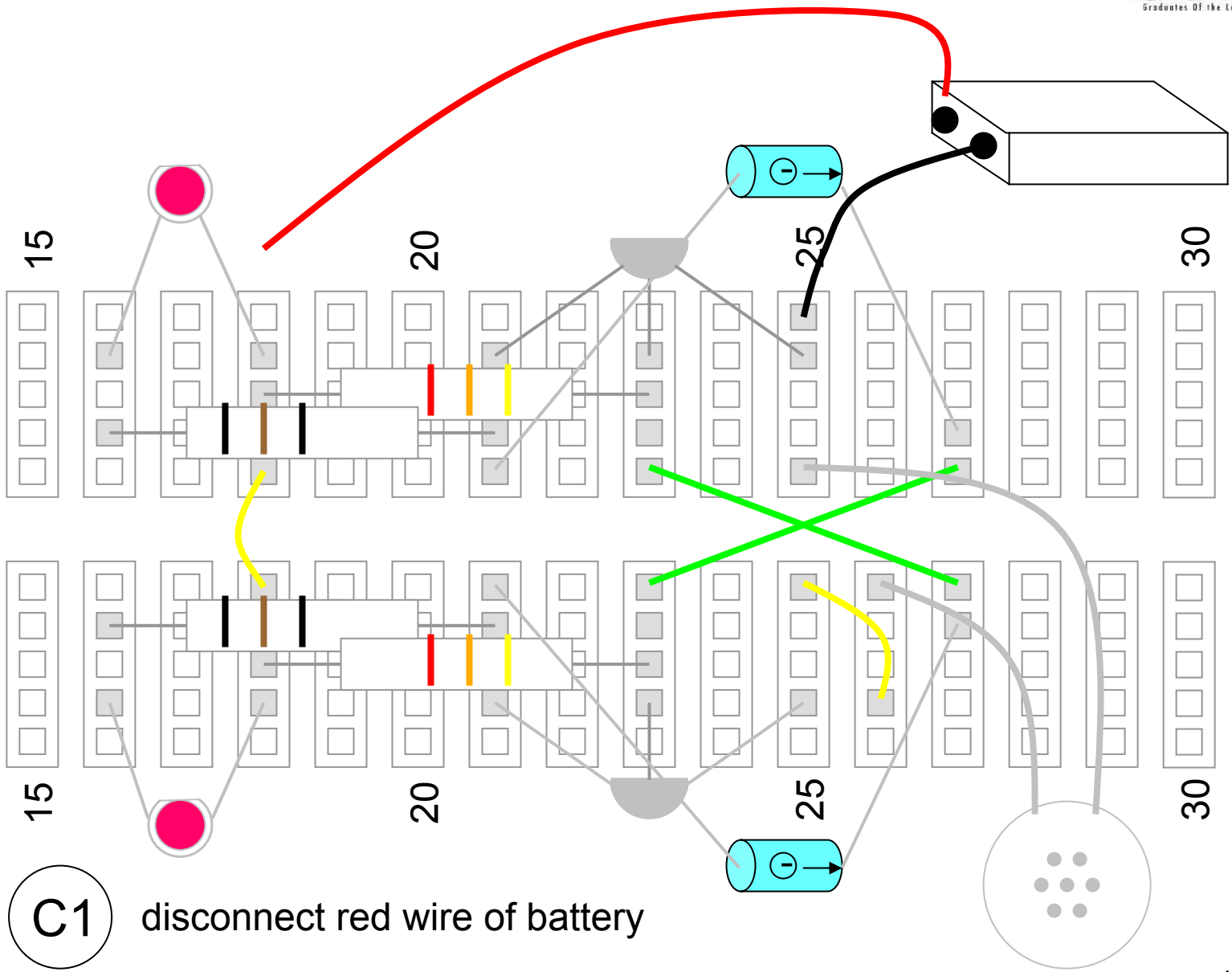



B4 reconnect red wire of battery at row 18

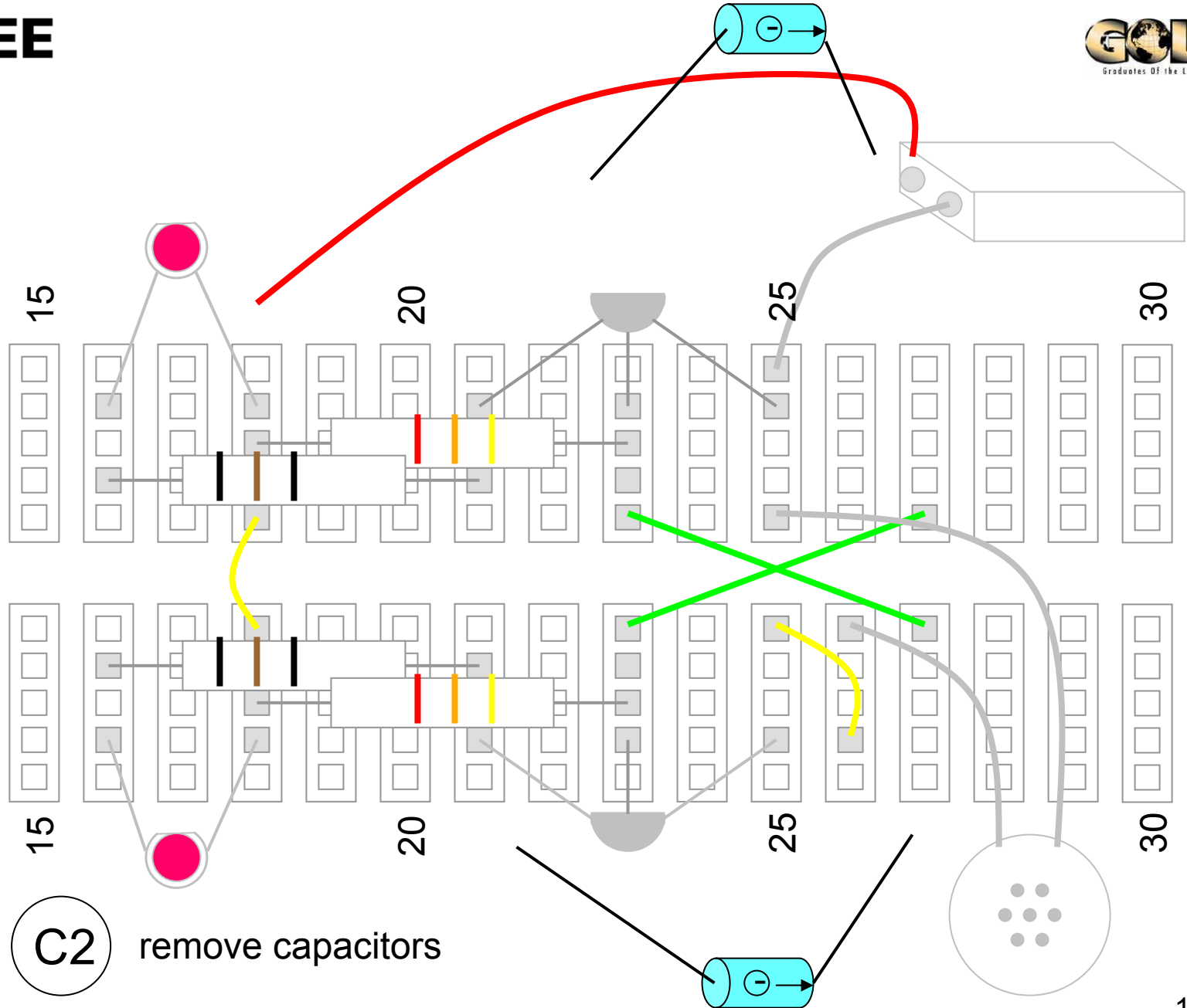
# Project C: flip-flop buzzer



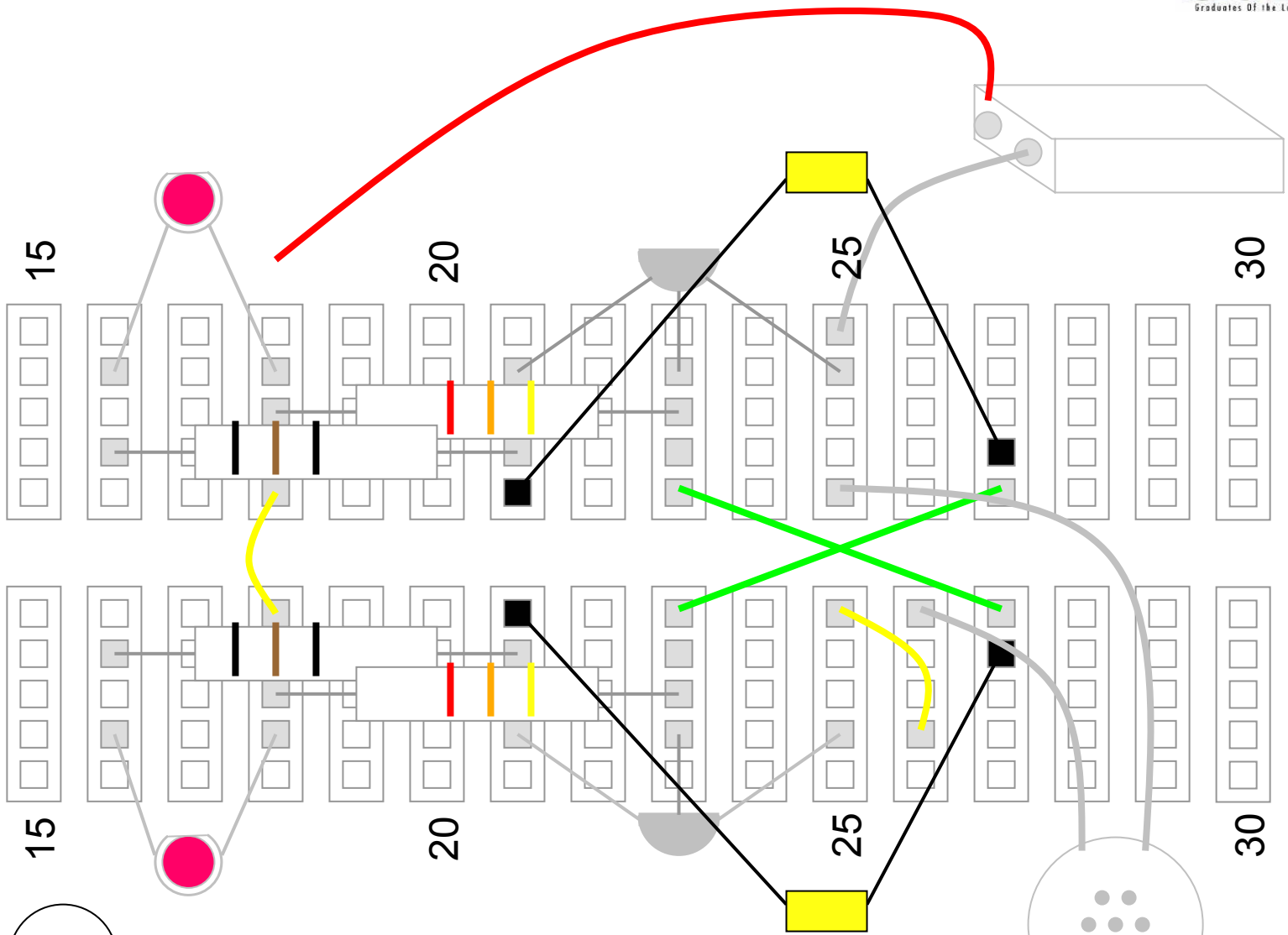

**C1, C2: 0.1-0.22 µF**
D1, D2: LED
R1, R4: 100 Ω
R2, R3: 10-100K
Q1, Q2: NPN
Vcc = 3V



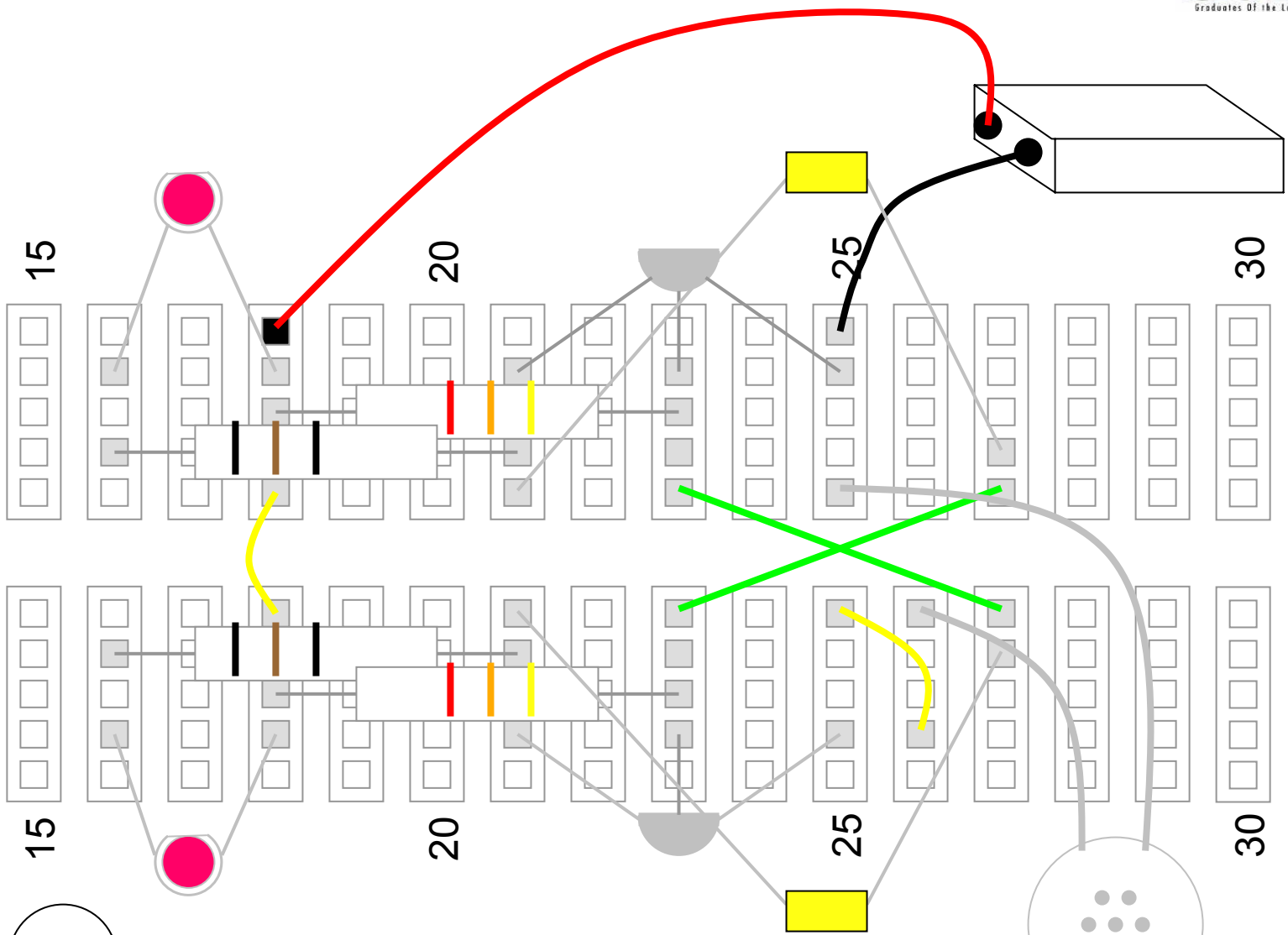

C1 disconnect red wire of battery




C2 remove capacitors

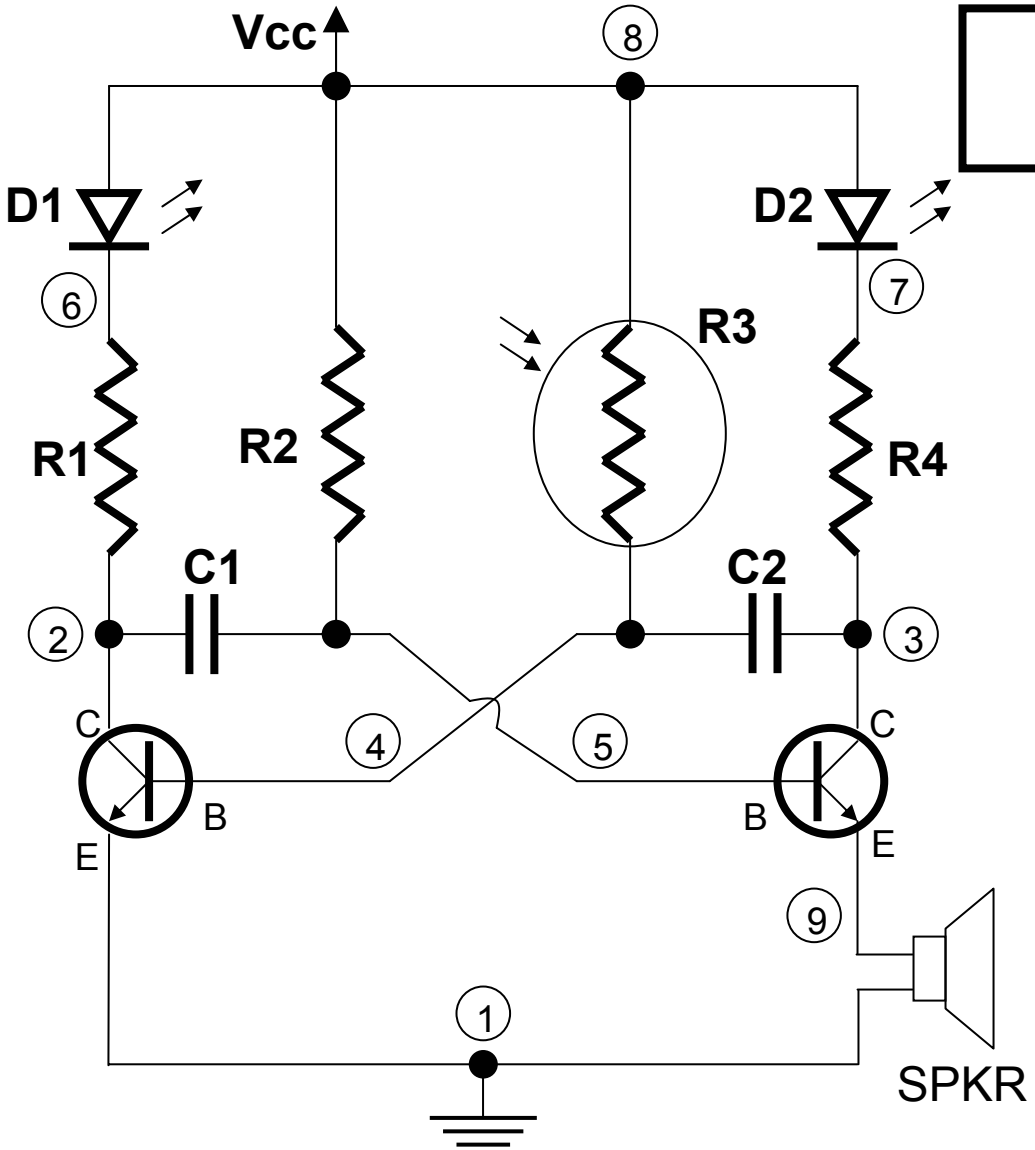



C3 add new capacitors (rows 21 and 27)

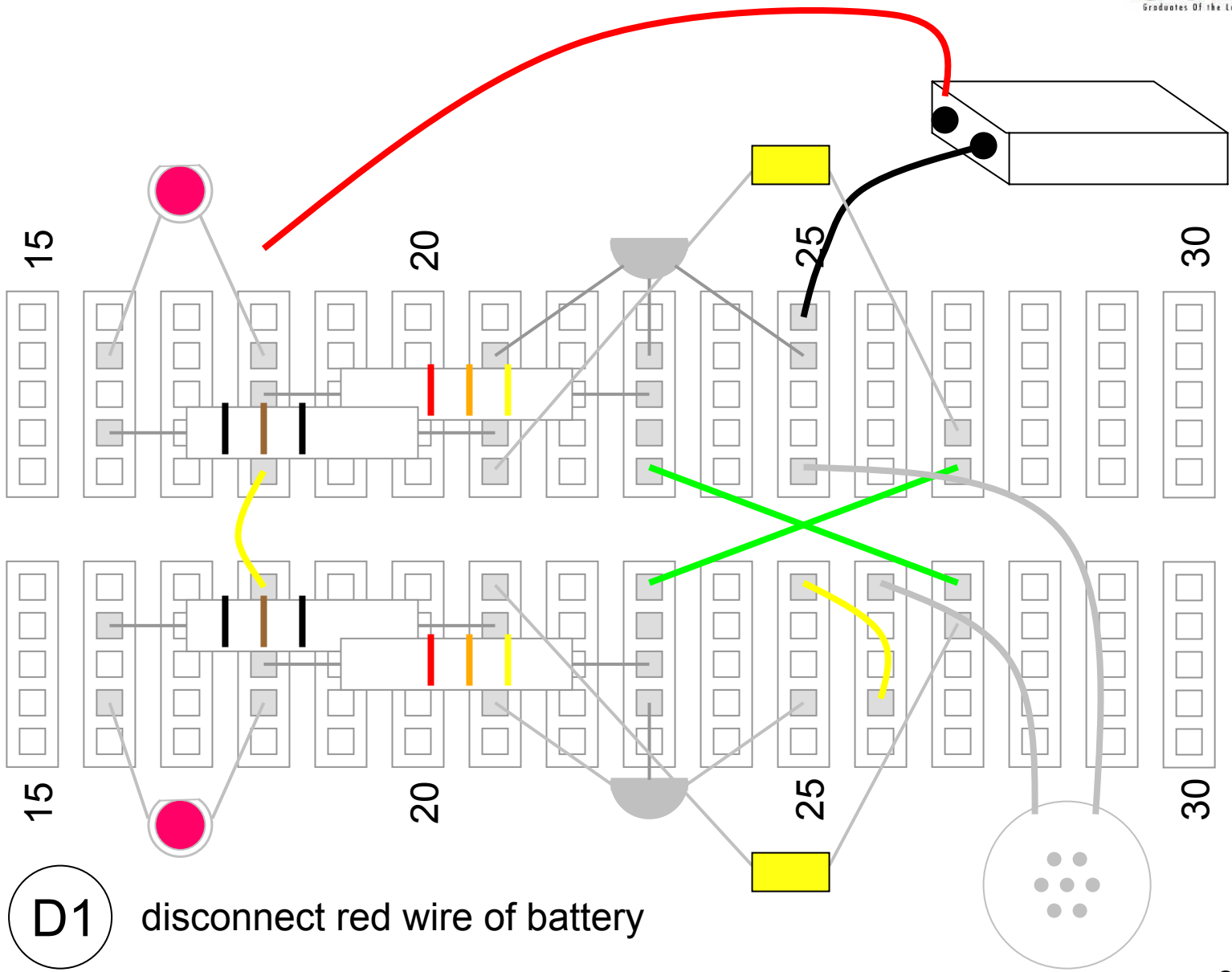



C4 reconnect red wire of battery at row 18

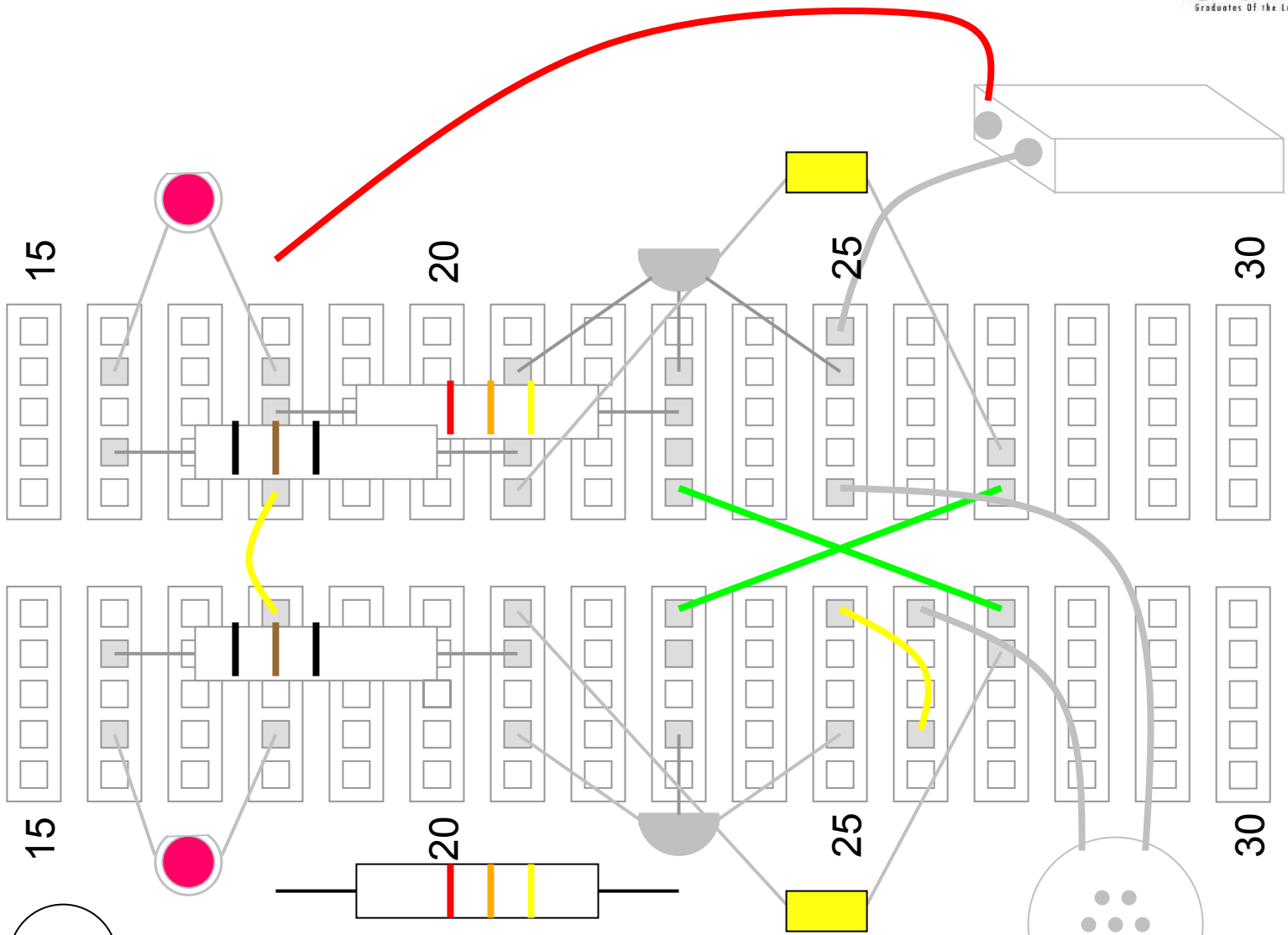
# Project D: light instrument



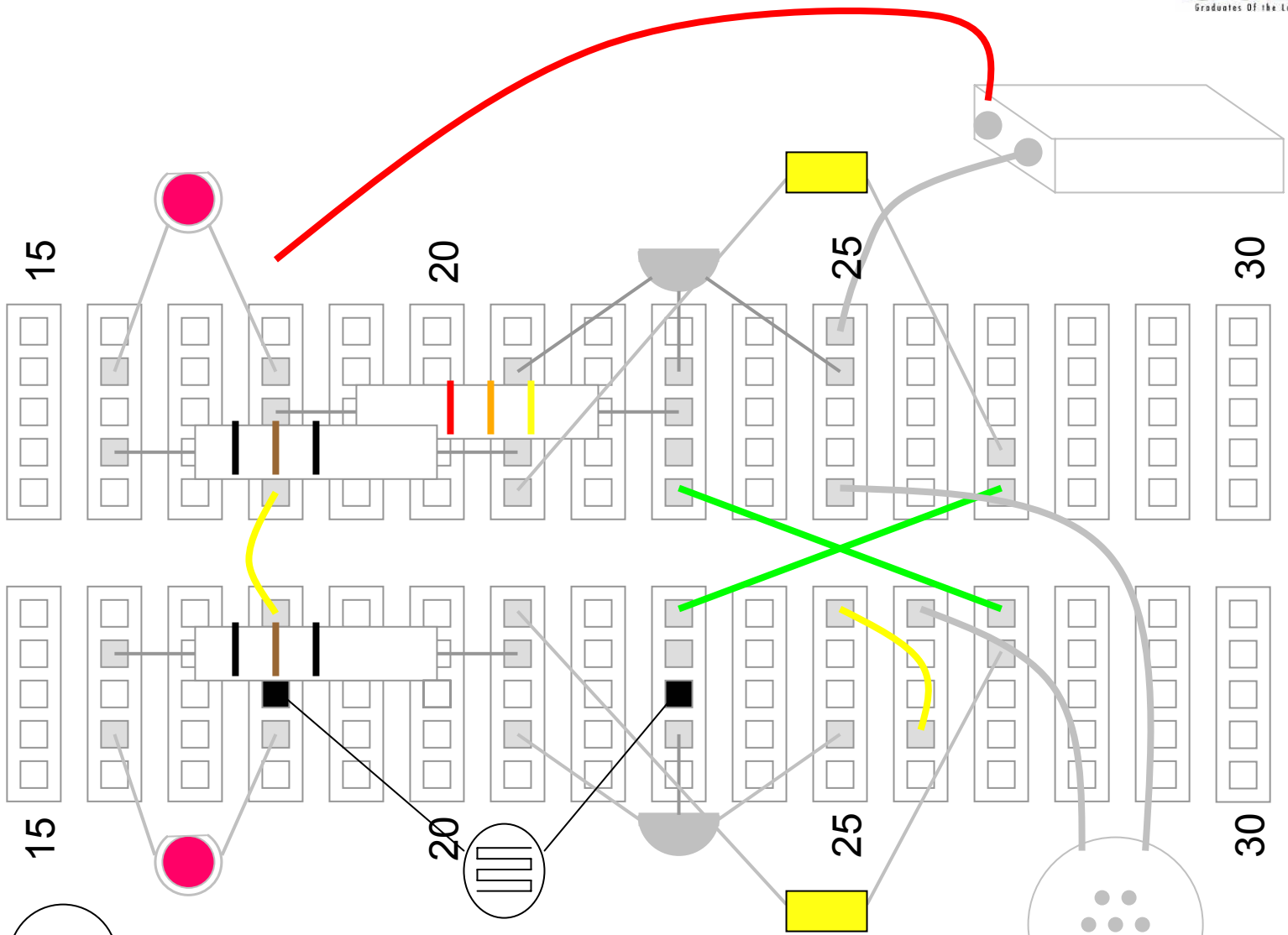

C1, C2: 0.1-0.22 µF
D1, D2: LED
R1, R4: 100 Ω
R2: 10-100K
**R3: CdS photocell**
Q1, Q2: NPN
Vcc = 3V



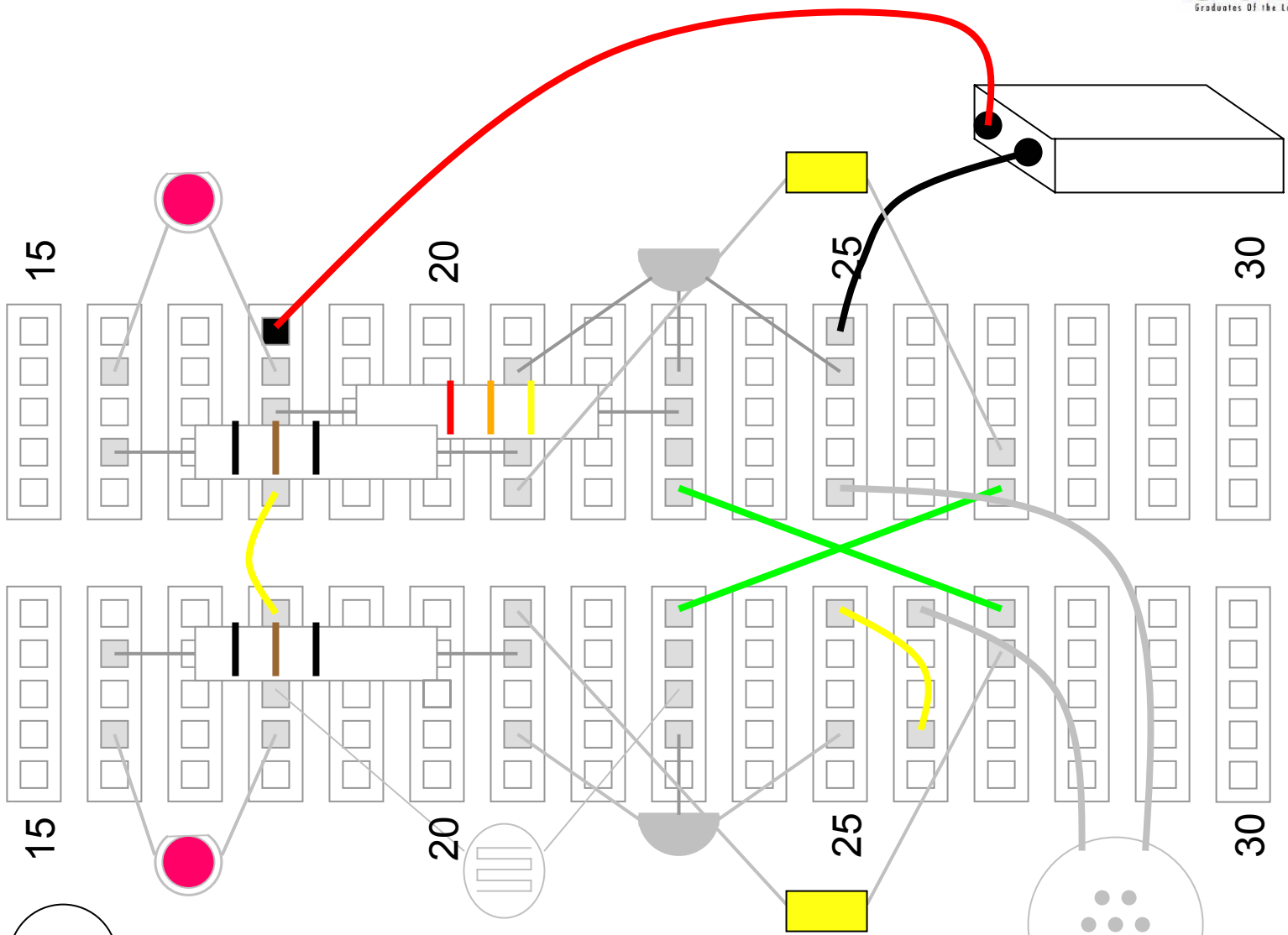

D1 disconnect red wire of battery




D2 remove one of the resistors at rows 18 and 23




D3 add photocell at rows 18 and 23 (where the resistor was)




D4 reconnect red wire of battery at row 18