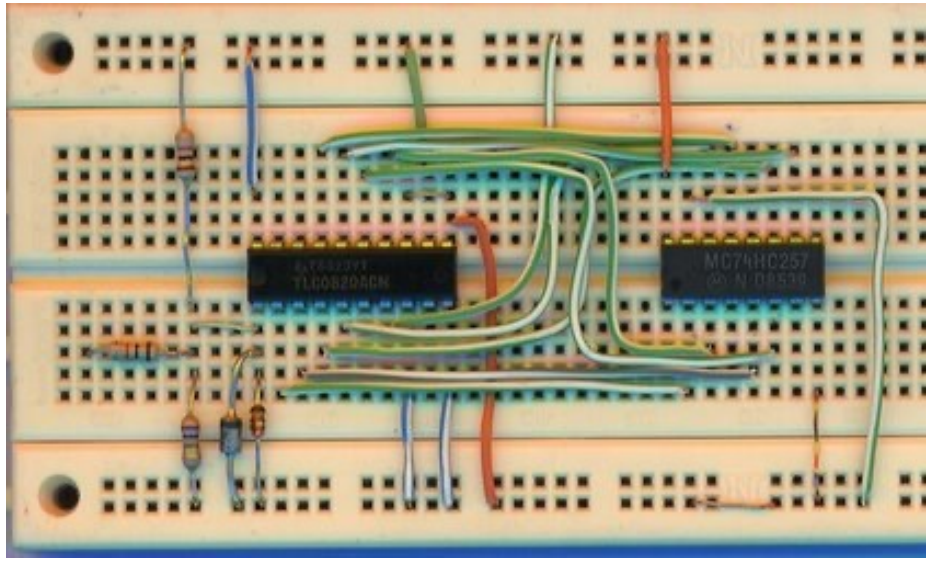
ELE 215
Linear Circuits Laboratory

Recitation 2

assembling circuits

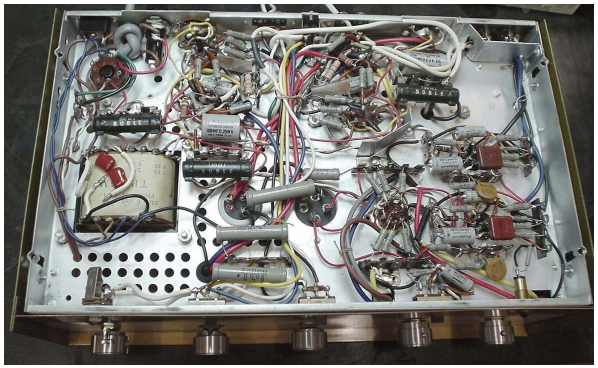
Breadboards



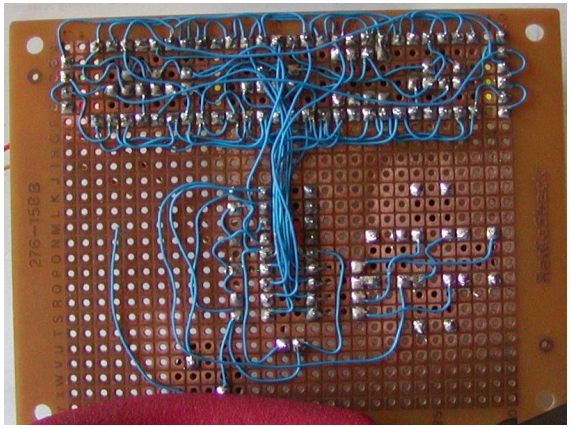
- As in ELE 202
- Fast to use, nice for ICs
- Temporary and fragile
- Not great for higher frequencies

Old Methods

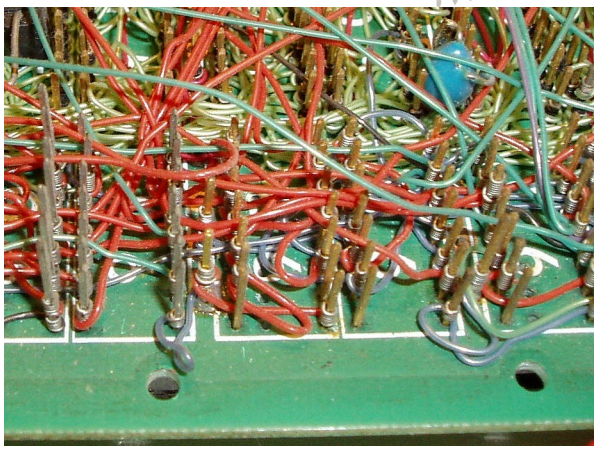
Point-to-point wiring



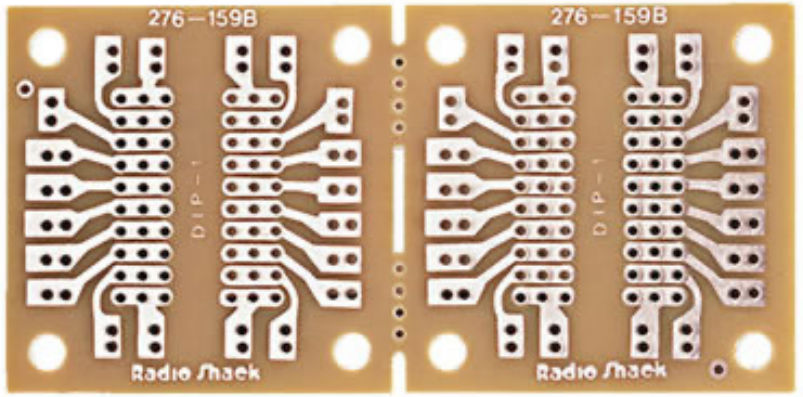
"Perf" board assembly



Wire wrap

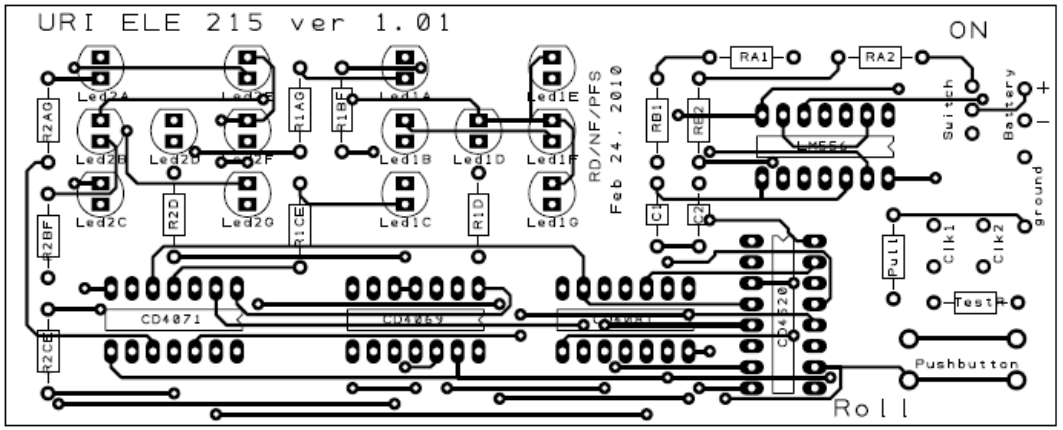


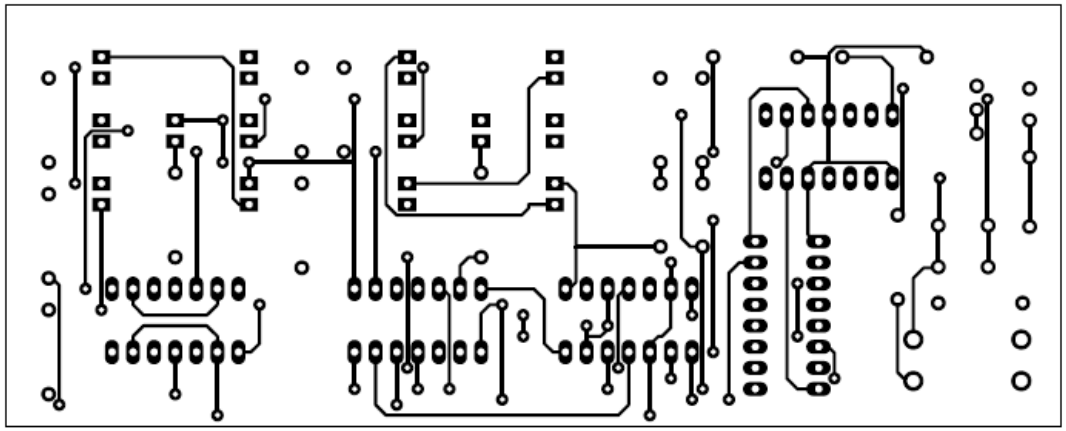
Generic printed circuit boards



Custom PCBs

- Fiber glass epoxy
  - 2 or more thin copper layers
- Acid etched
- Silk-screen printing
- Parts soldered on
  - Topic of lab

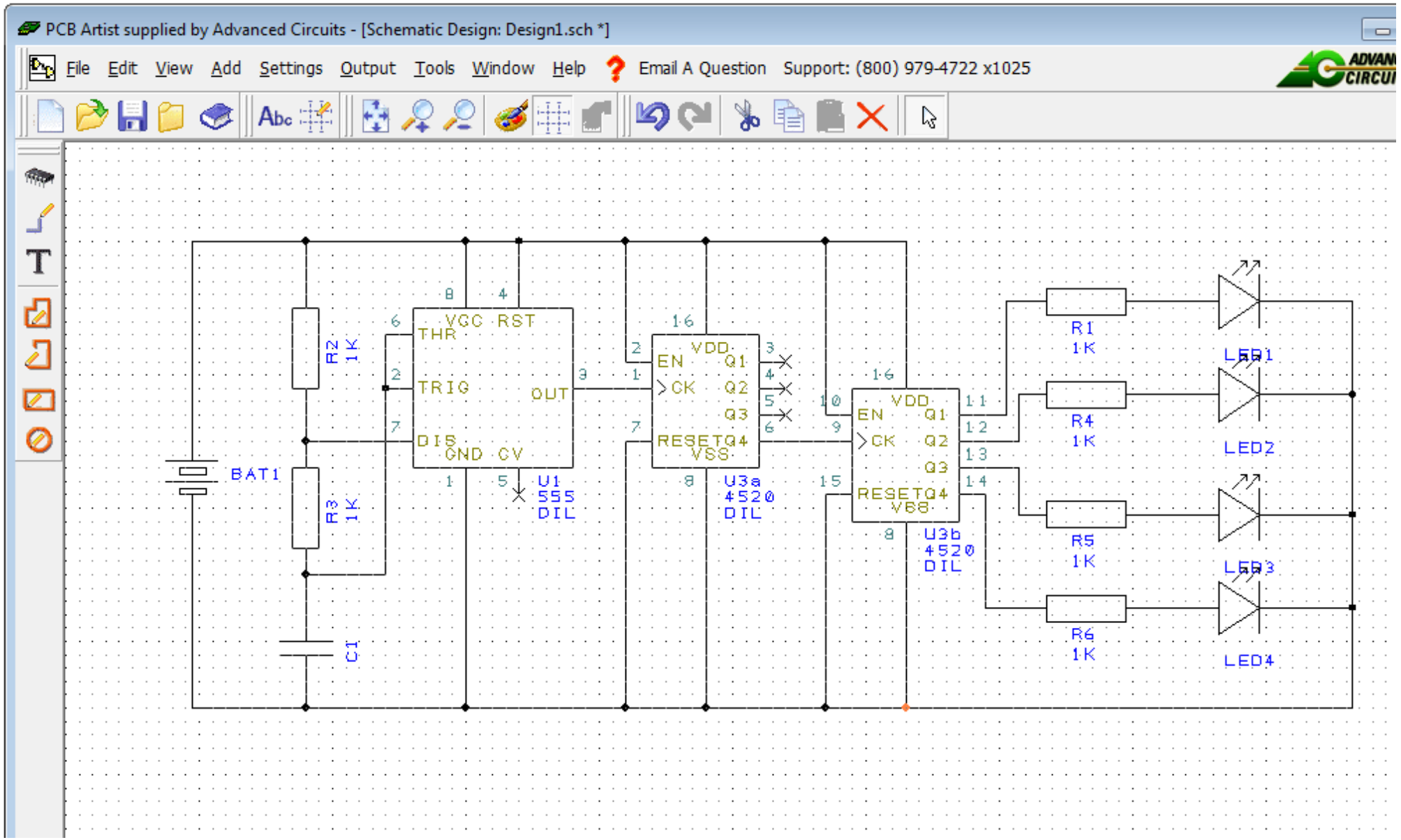




- CAD tool for design
  - Schematic capture: circuit layout using parts from a library (e.g. MultiSim)
  - Transfer to PCB tool
    - Locate parts on desired board size
    - Algorithm tries to “route” connections
    - Rule checking of result
  - Produces Gerber file

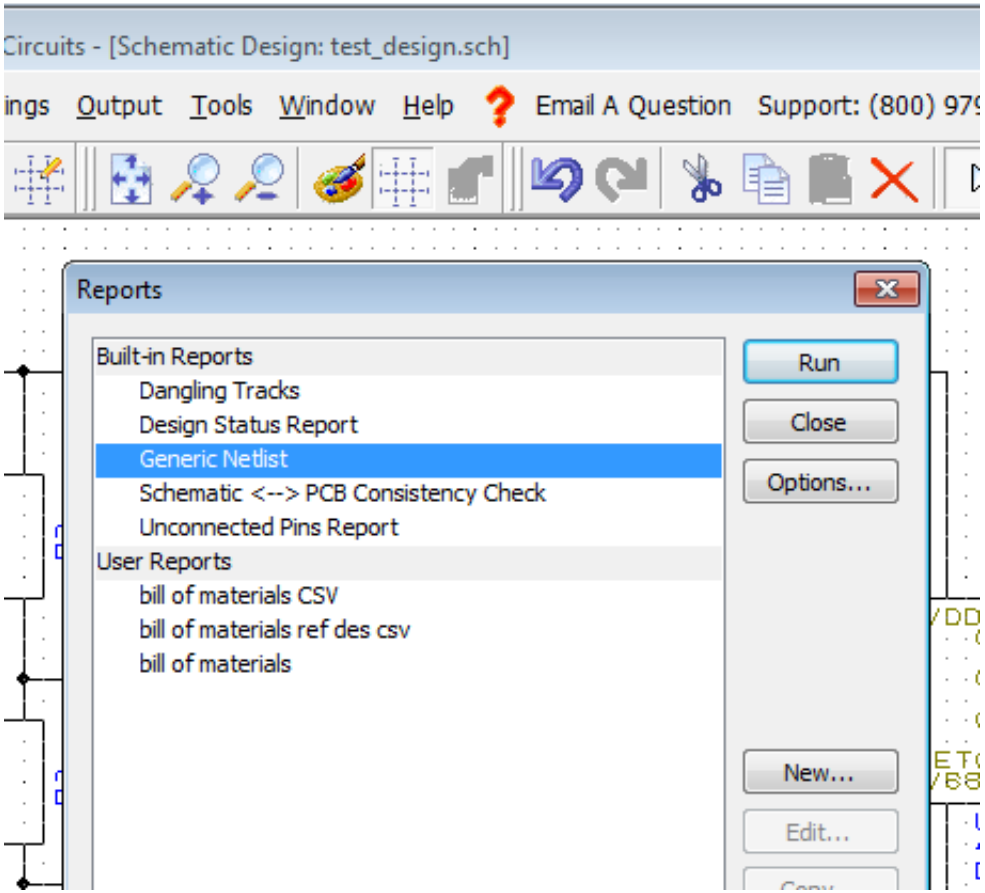
- Sent out for manufacturing

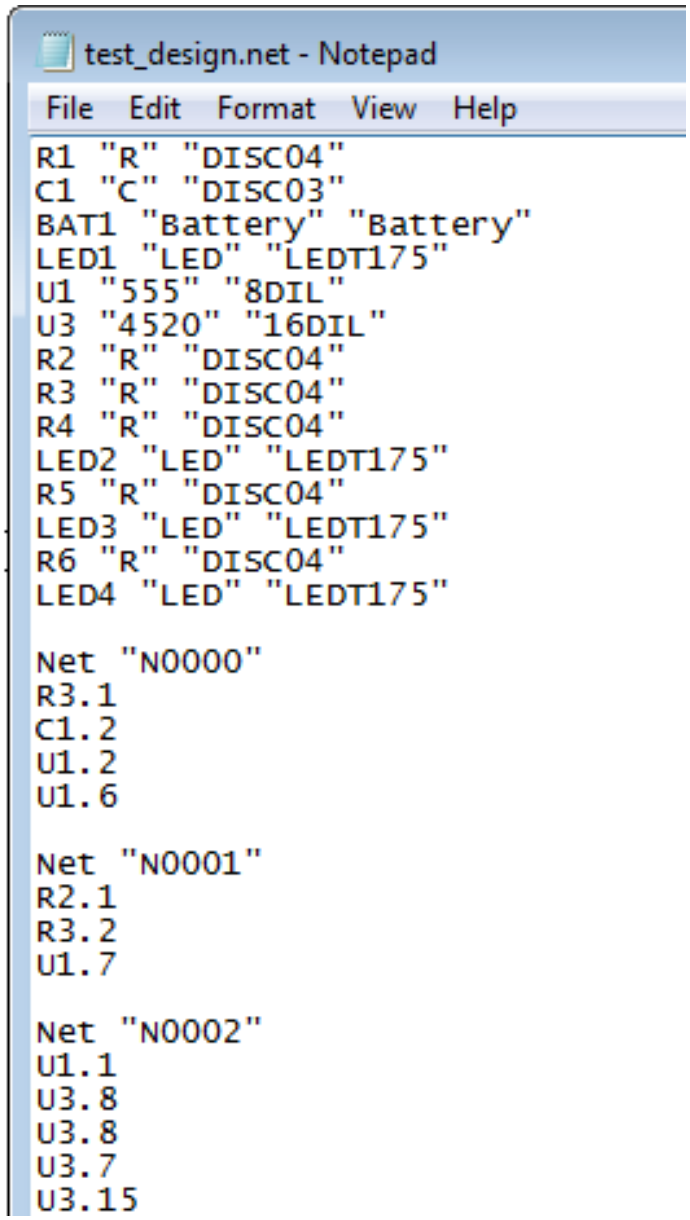
Schematic Capture – 4 bit counter



Various “reports” are available:

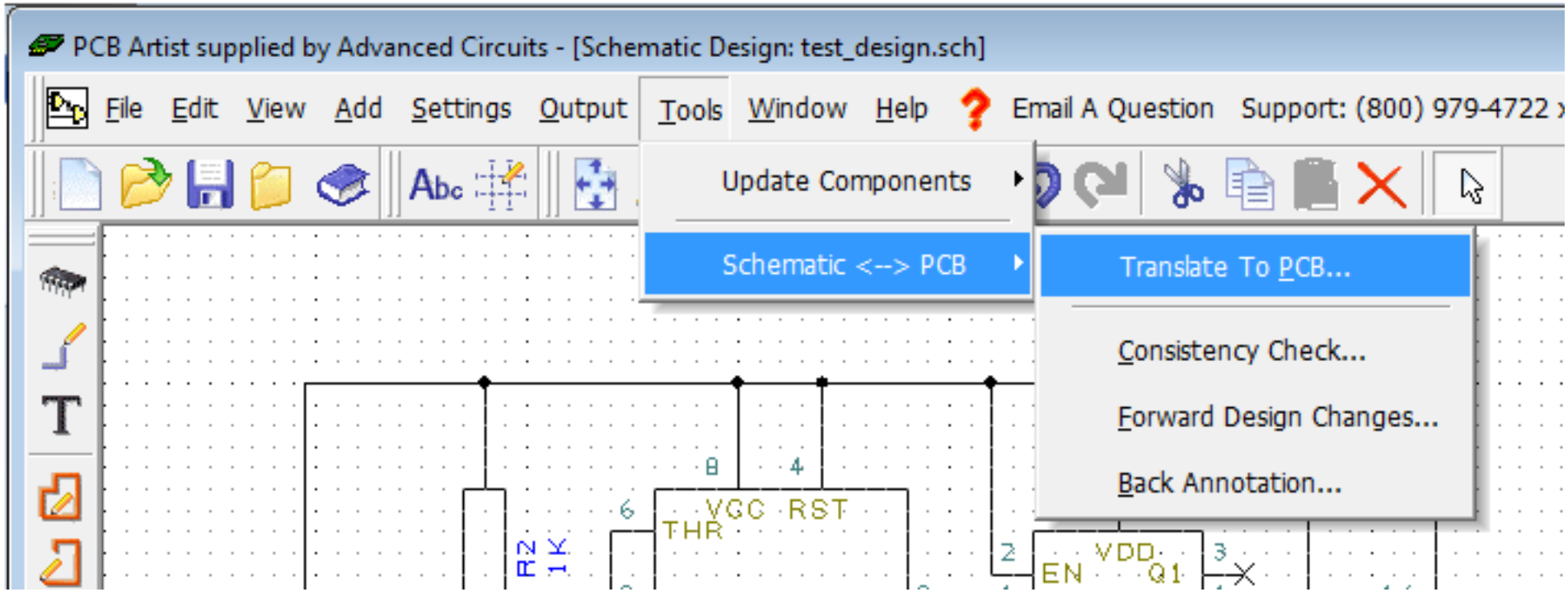
- Netlist



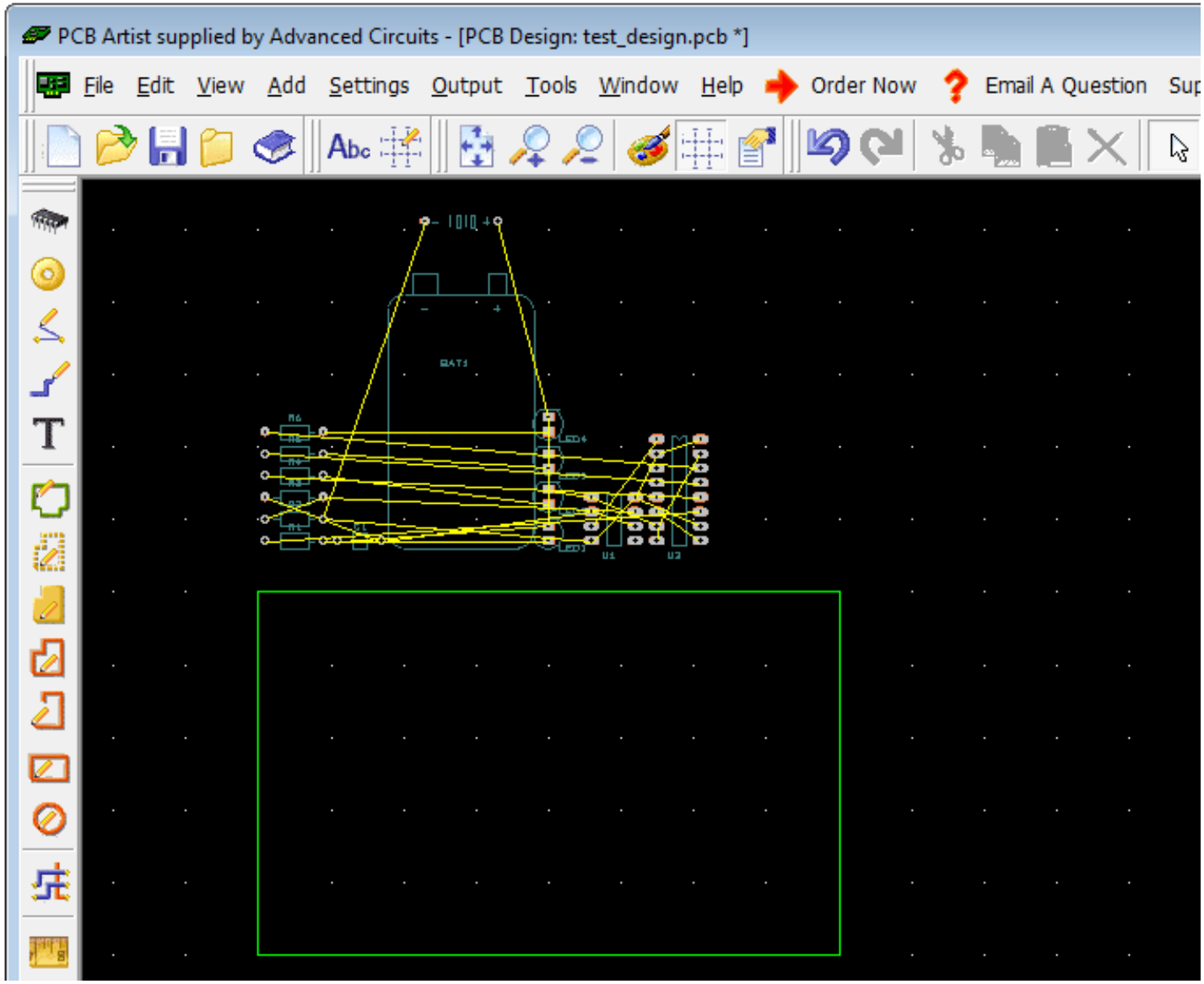


Converting to PCB

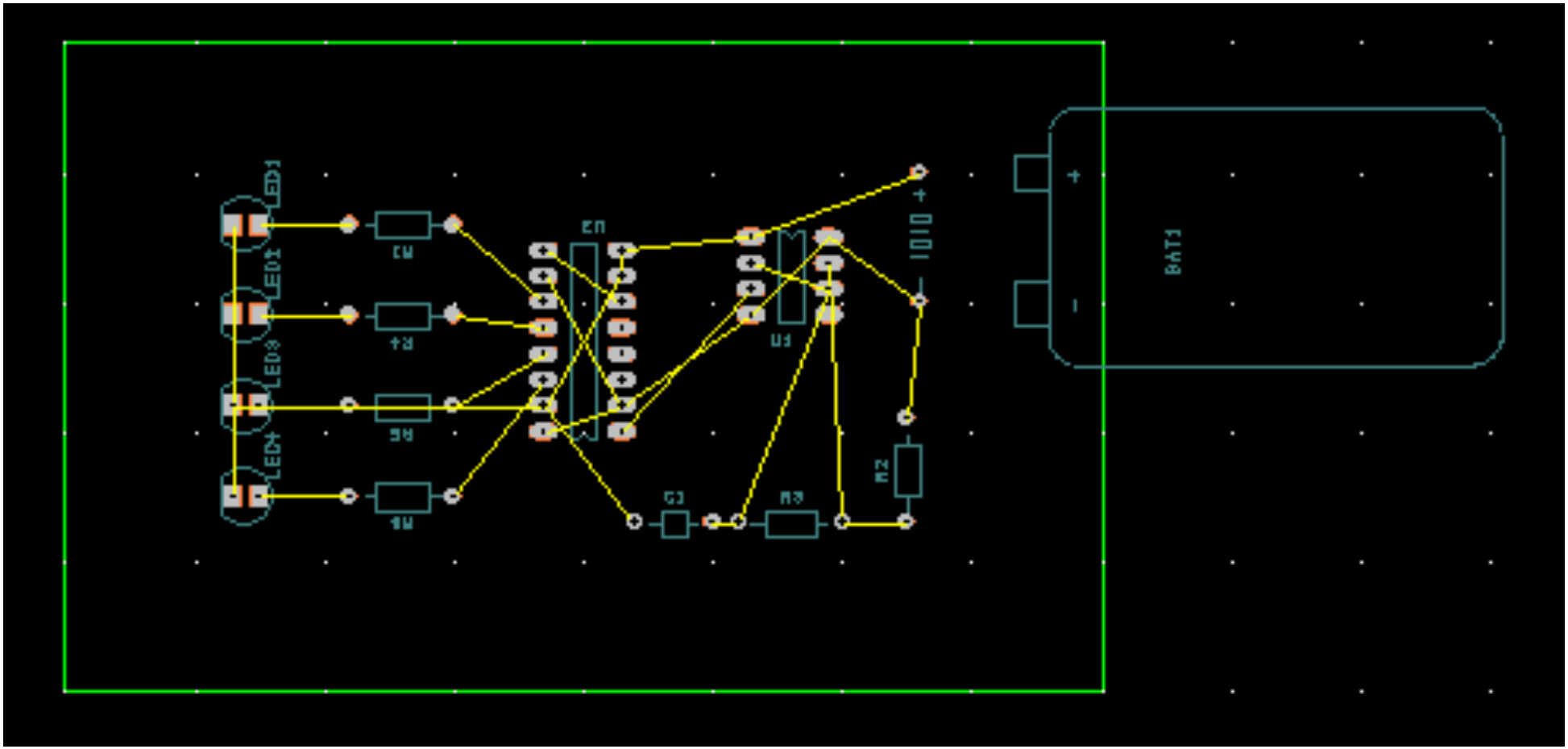
Schematic Capture:



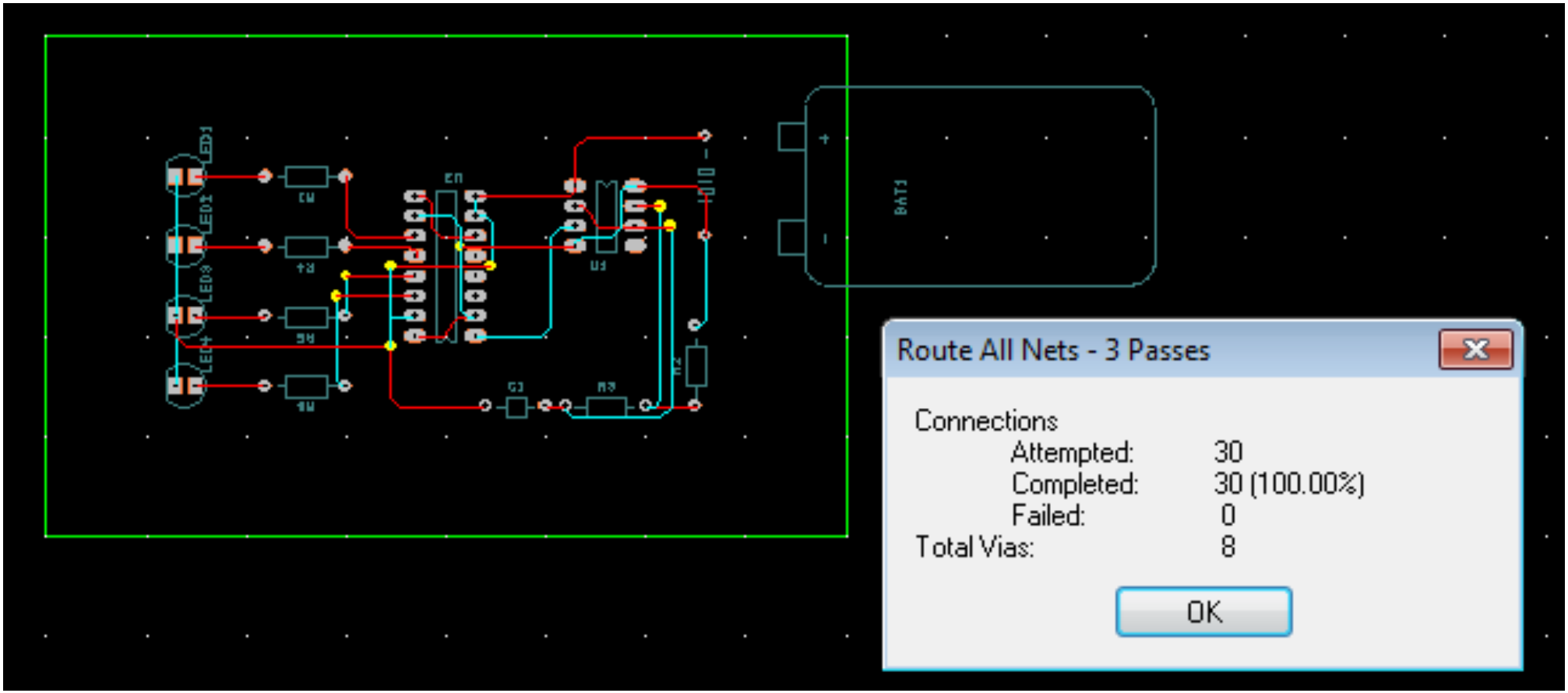
Transfer to Board:



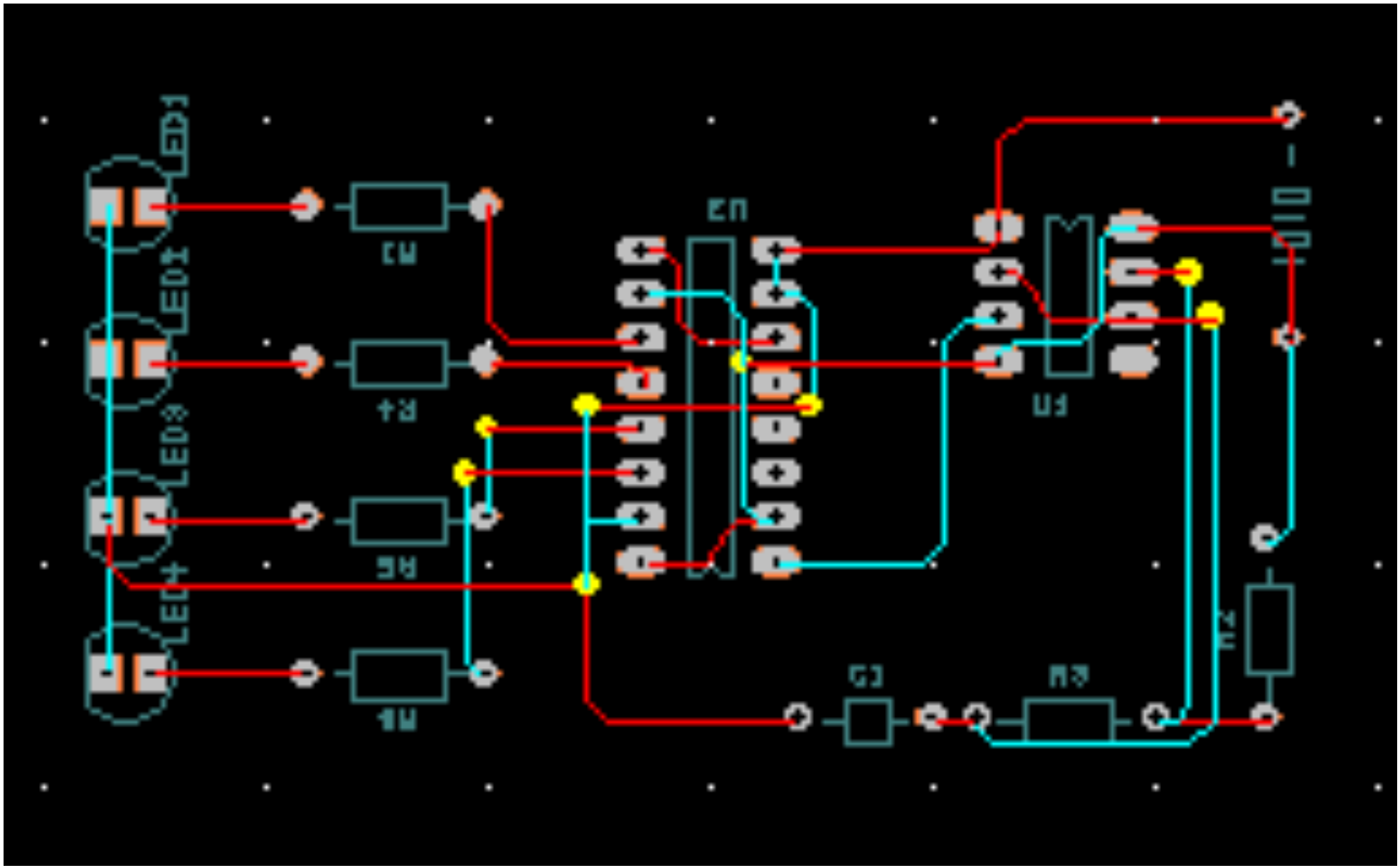
Position the Parts:



Route:

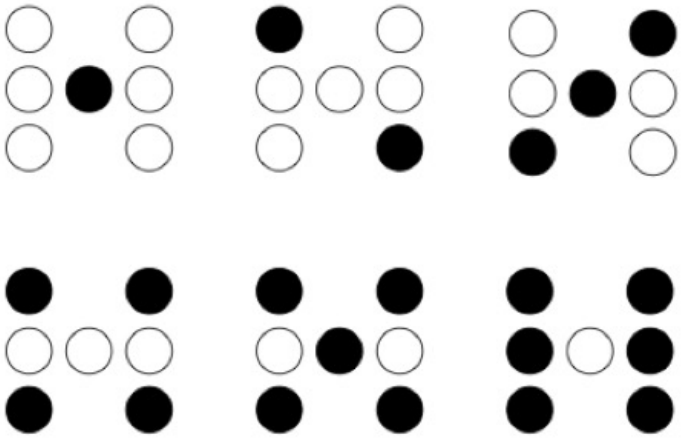

Route All Nets - 3 Passes
Connections
Attempted: 30
Completed: 30 (100.00%)
Failed: 0
Total Vias: 8
OK

The Final Result:



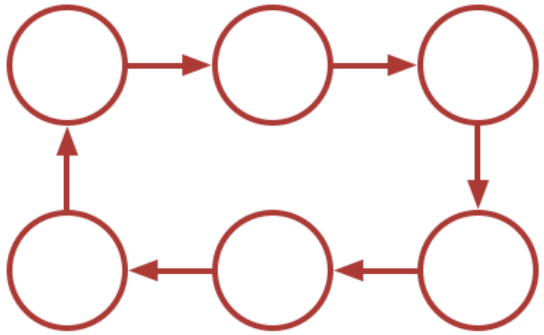
Our Lab PCB – Virtual Dice

- 6-sided die
  - 7 LEDs for the pips

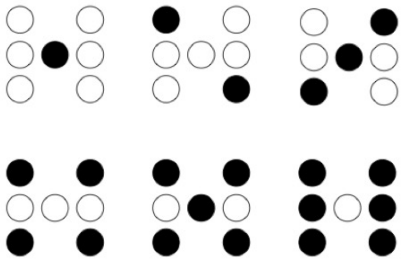


- Want a “random” effect
  - Use a fast “counter” and stop it at a random time
  - One state per outcome

Details

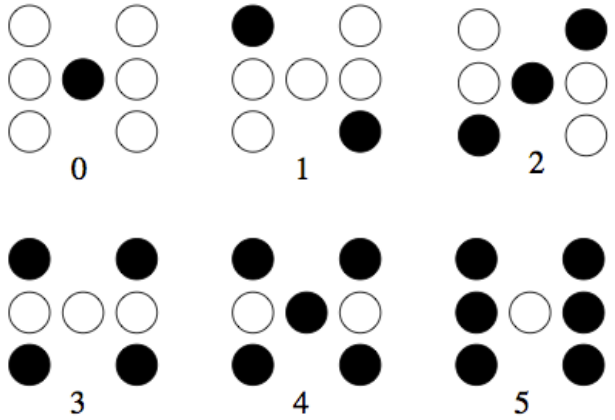


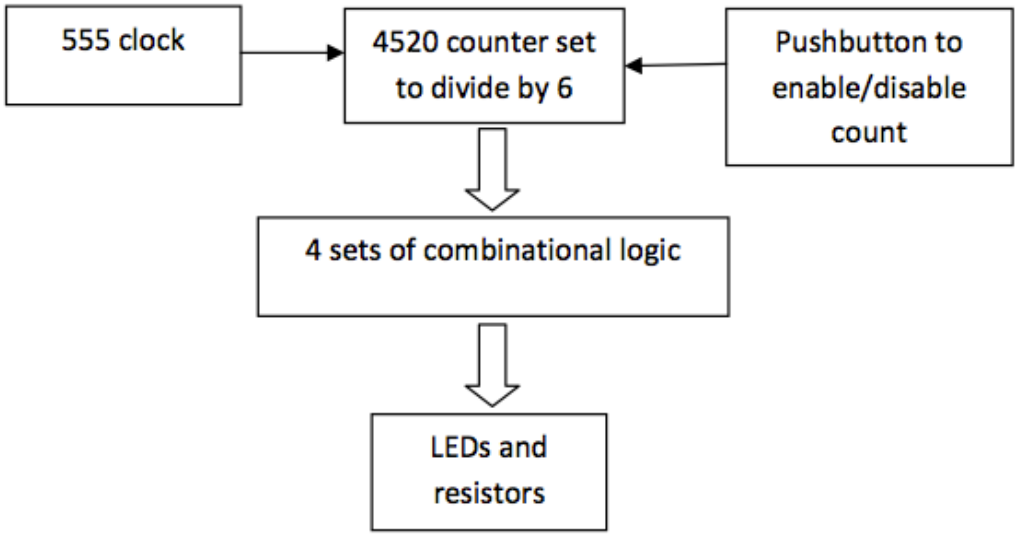
- FSM with 6 states:
  - Count sequence:
    - 1-2-3-4-5-6-1-2-…
    - Some other sequence? Does it matter?
  - FF type: D or JK or use standard counter?
  - Output mapping:
    - 1 → 1, 2 → 2, … 6 → 6
    - Some other mapping? Does it matter?
- Note – 7 LEDs, but only 4 outputs needed
  - Center, 2 on sides, 2 pairs of opposite corners



Which choices for lab?

- 2 separate “channels”
  - 556 for clocks
  - 4520 counter set to reset on 6
  - Combo logic to light LEDs





Specifics for next week

- Lab 2 – 60 points (individual)
  - Only ½ of you should attend next week; the other ½ should delay a week; a third week is provided for late completion
    - Weekly lists are posted on the ELE215 website
  - Instructions posted on ELE 215 website
  - Summary sheets available in lab rooms and on website
    - Due by 5 PM Wednesday Feb 18