Final Skills Exam

Course Code: CPE 304

Course Title: Computer Engineering, Drafting and Design

Section: CPE23S1

Members:
San Juan, Edson Ray E.

1. Objective(s):
To design, build, test, and document three different types of working electrical circuits to demonstrate understanding of computer engineering, drafting and design.

2. Intended Learning Outcomes (ILOs):

The students shall be able to:

2.1 Create a circuit design for the given problem

2.2 Etch the circuit design in a PCB

2.3 Solder the components and test its effectiveness.

3. Discussion:

Circuit 1: An LED On/Off circuit

-is a basic electronic switching circuit where an LED is turned ON or OFF depending on the state of a switch that controls the current flow through the LED. The circuit includes essential components like a power source, current-limiting resistor, switch, and the LED.

Circuit 2: Choose 1 between Problem 1 and 2

1. Prob 1: Buzzer alarm based on switch conditions
2. Prob 2: Buzzer When More Than 2 Lights Are ON (Out of 4)

Circuit 3: Continuity Tester

-is a device that checks and identifies a connection between two points. It checks the connection and lets us know if the connection or wire on the PCB is broken or the circuit is open due to failed components

4. Materials and Equipment:

Refer to previous activities

5. Procedure:

Part 1: Circuit Testing

1. All circuits were designed, etched, drilled and soldered in the previous activities.
2. Test the circuits to ensure they work. All components should be connected correctly.

Part 2: Evidence Collection

For each circuit, submit the following:

Title each section clearly (Circuit 1: *Title*, Circuit 2: *Title*, Circuit 3: *Title*).

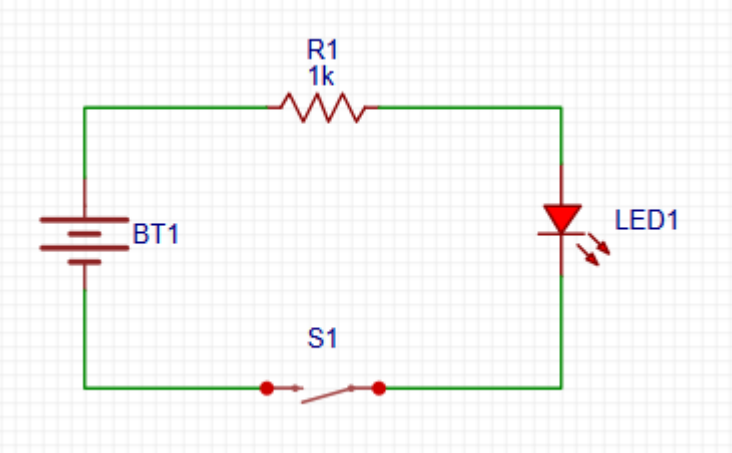
1. Clear photo of the working circuit (multiple photos to provide evidence of working circuit ex. LED on, LED off).
2. Circuit diagram (hand-drawn or digital circuit design).
3. Brief explanation of how each circuit works (3–5 sentences).

6. Data, Results and Analysis: *(photo, circuit and explanation)*

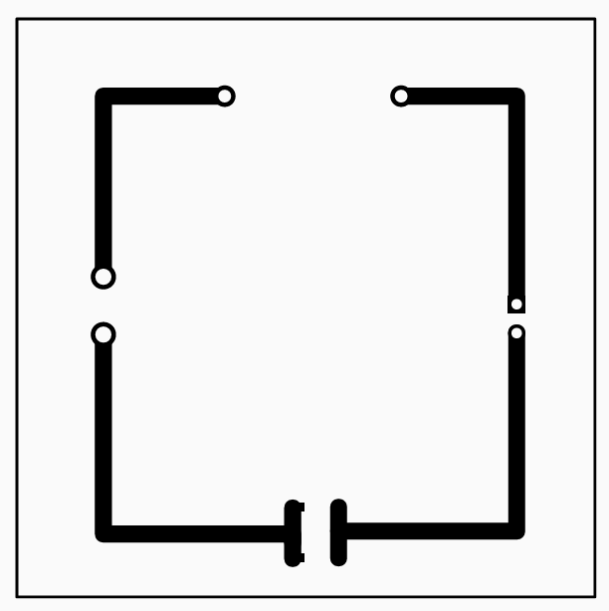
Circuit 1: An LED On/Off circuit

- **Components**
  - **LED**
  - **Switch**
  - **1K Resistor**
  - **9v Battery**
  - **Battery Connector Clip**

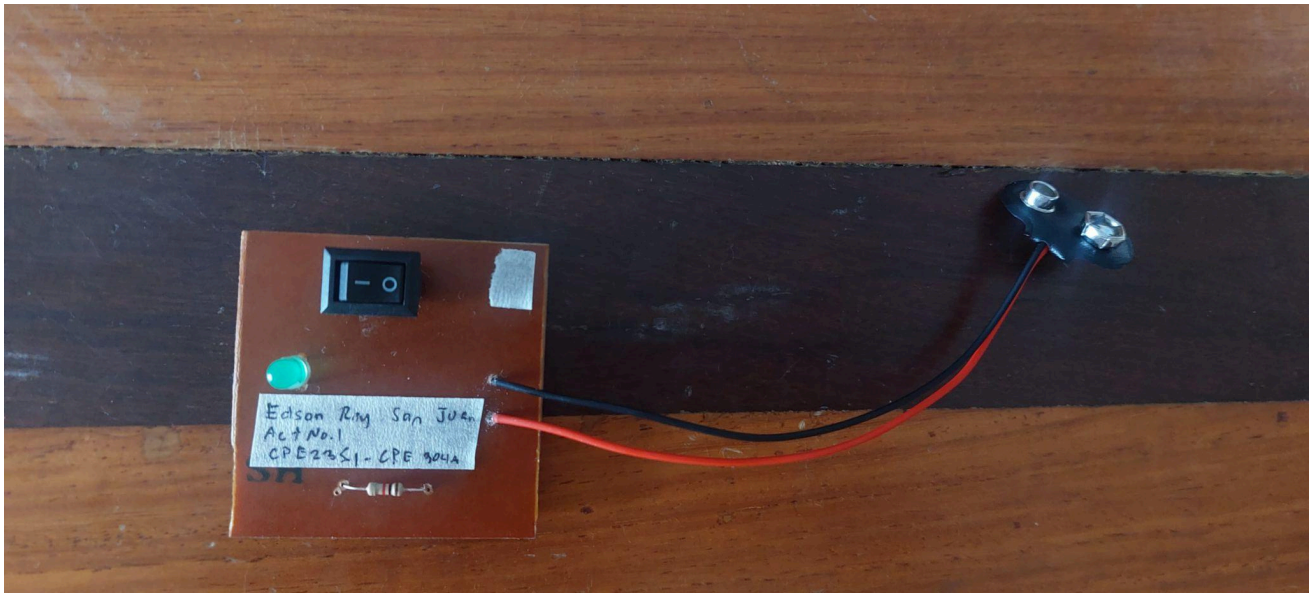
- **Easy Eda Schematic**



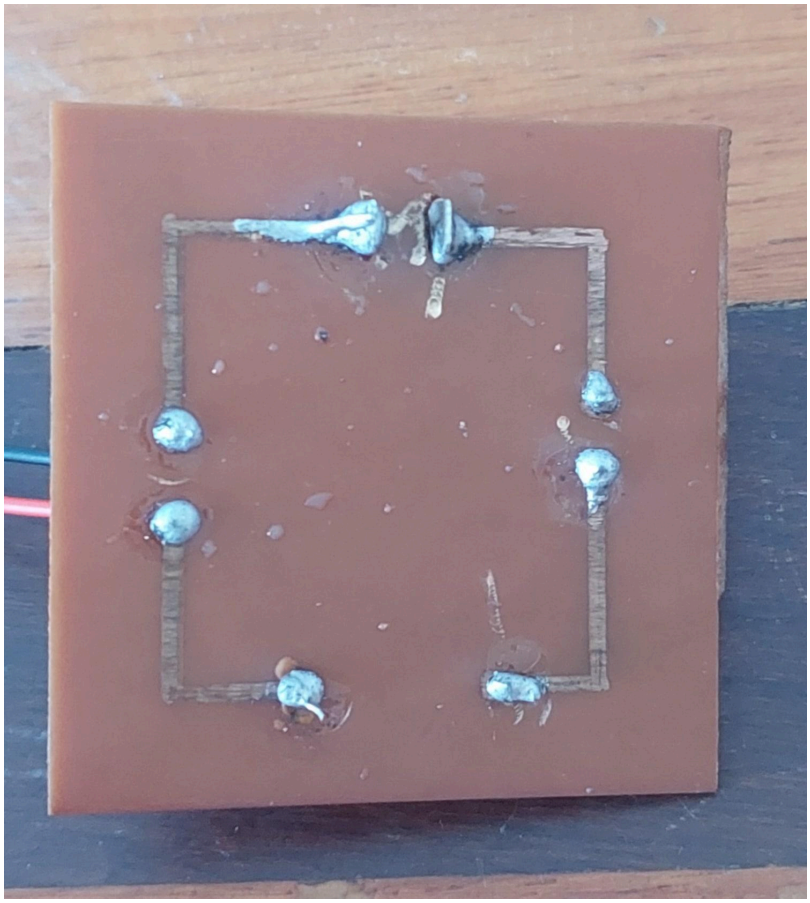
- **Easy Eda Circuit PCB**



- **Front Side View (Components)**



- **Back Side View (Circuit Diagram)**



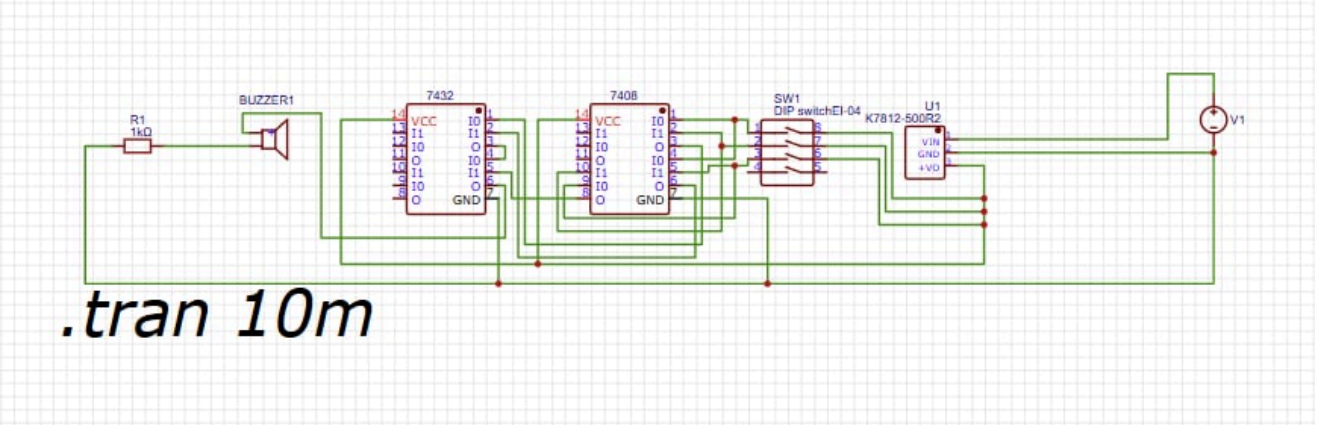
VIDEO LINK DEMO: ACT 1 DEMO.mp4

- **Output: ACT 1 OUTPUT.mp4**
- **Conclusion:** I've concluded that I've created a simple LED circuit with a switch using a 9V battery and a 1kΩ resistor to limit the current and protect the LED, as well as a switch to easily turn the LED on and off. This setup is safe, effective, and ideal for beginners learning about basic electronics. This circuit serves as my foundation to create more complex circuits and eventually etch them onto a PCB.

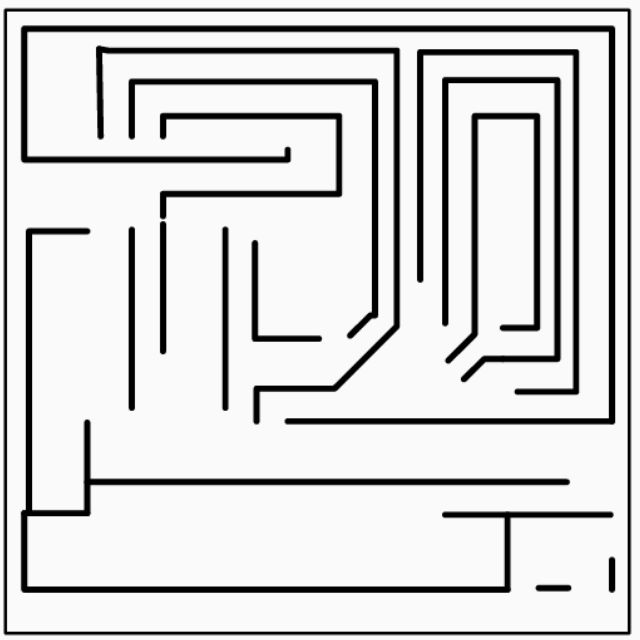
Circuit 2: Choose 1 between Problem 1 and 2

- **Components:**
  - **7408 IC (AND GATE)**
  - **7432 IC (OR GATE)**
  - **Piezo Buzzer**
  - **3 pcs. 1k ohms resistor**
  - **Battery Snap**
  - **7805 transistor (Voltage Regulator)**
  - **Dip switch (8 Way)**

- **Easy Eda Schematic**

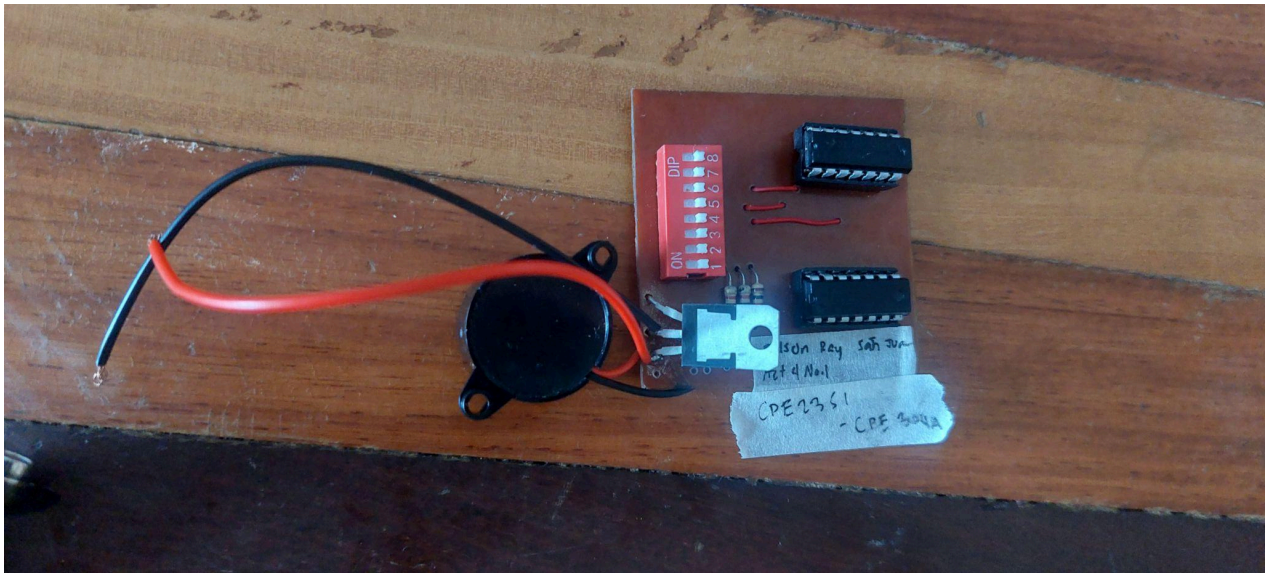


- **Easy Eda Circuit PCB**

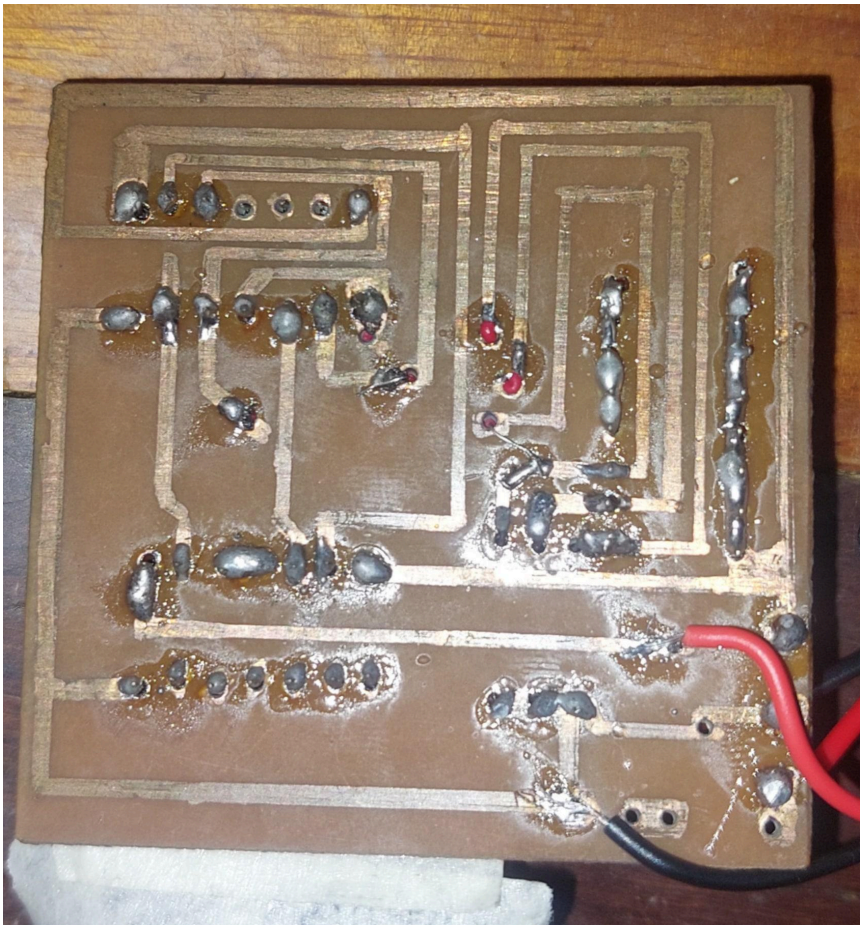


Prob 1: Buzzer alarm based on switch conditions

- **Front Side View (Components)**



- **Back Side View (Circuit Diagram)**



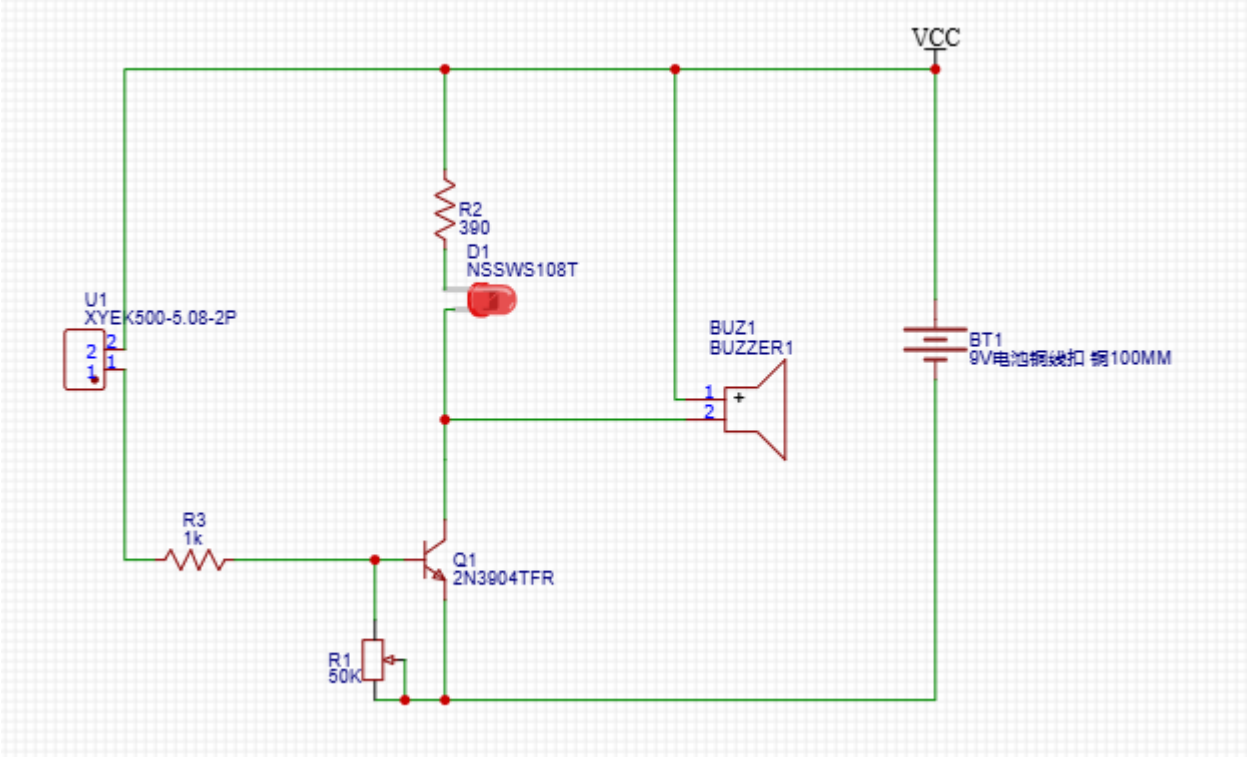
VIDEO LINK DEMO: ACT 4 Prb 1 DEMO.mp4

- **Output: ACT 4 Prb 1 OUTPUT.mp4**
- **Conclusion:** I concluded that in Activity 4, Problem 1, I designed a circuit where the buzzer sounds when at least two out of three, or all three, switches are turned on. To achieve the required logic, I used AND (7408) and OR (7432) ICs, and I included a 7805 voltage regulator to maintain a steady 5V power supply from the 9V battery. Due to limited components, I used an 8-input DIP switch even though only three inputs were needed, so the remaining inputs were treated as don't care conditions.

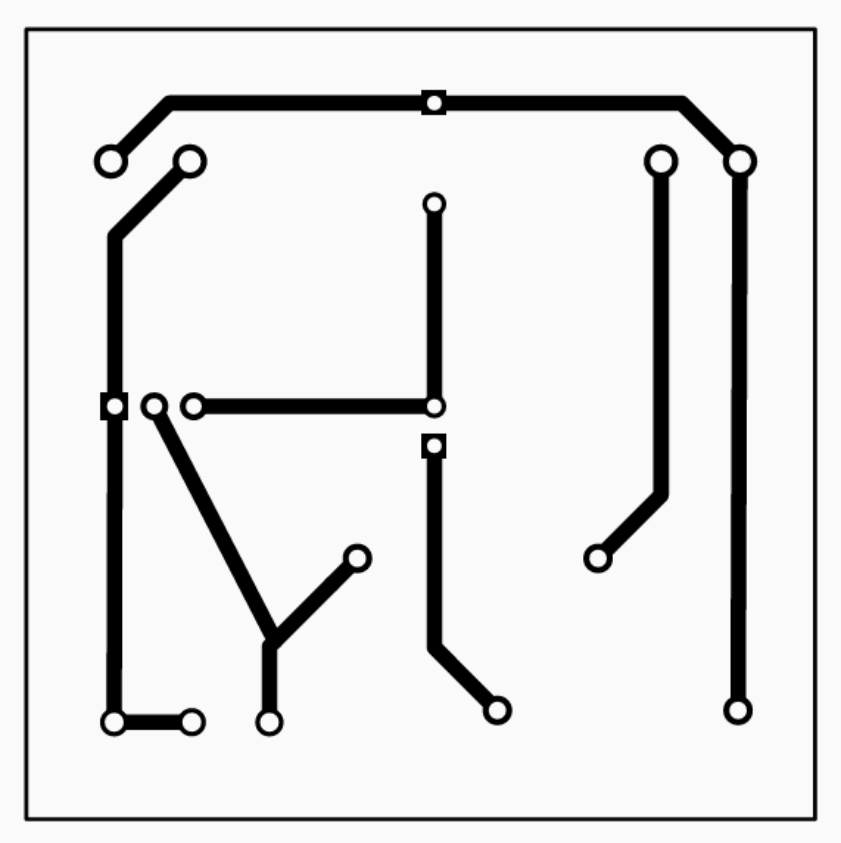
Circuit 3: Continuity Tester

- **Components:**
  - **LED**
  - **Piezo Buzzer**
  - **2N3904 (NPN Transistor)**
  - **390m ohms resistor**
  - **1k ohms resistor**
  - **50k ohm potentiometer**
  - **2 pcs. Test probes**
  - **9v BT**

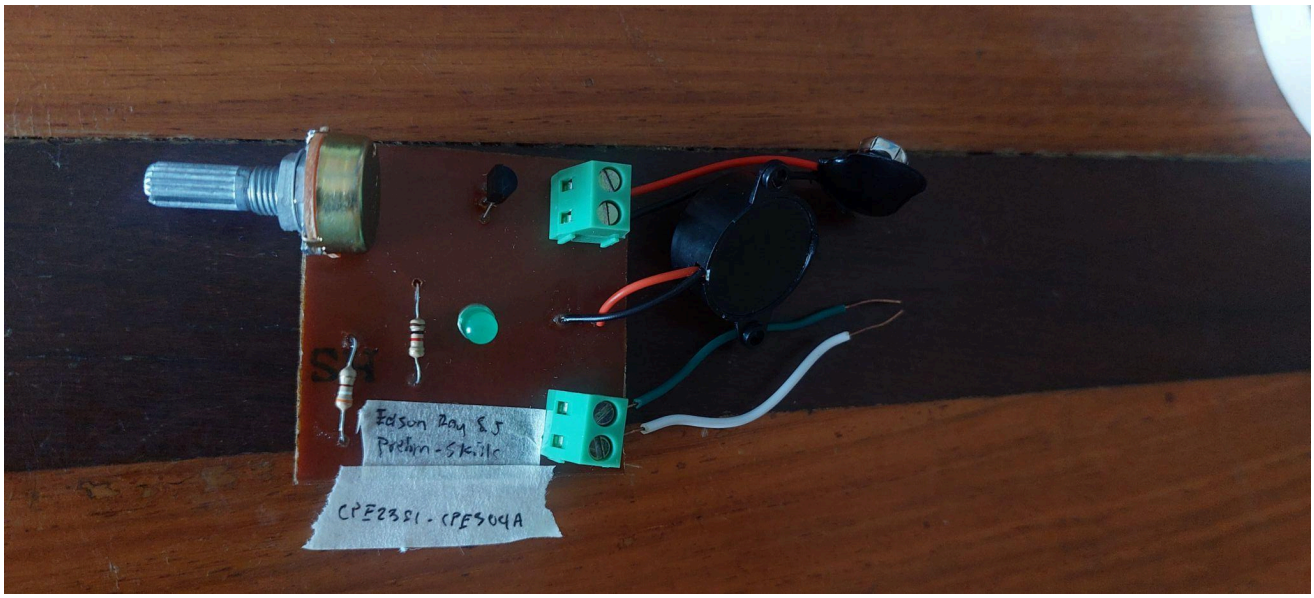
- **Easy Eda Schematic**



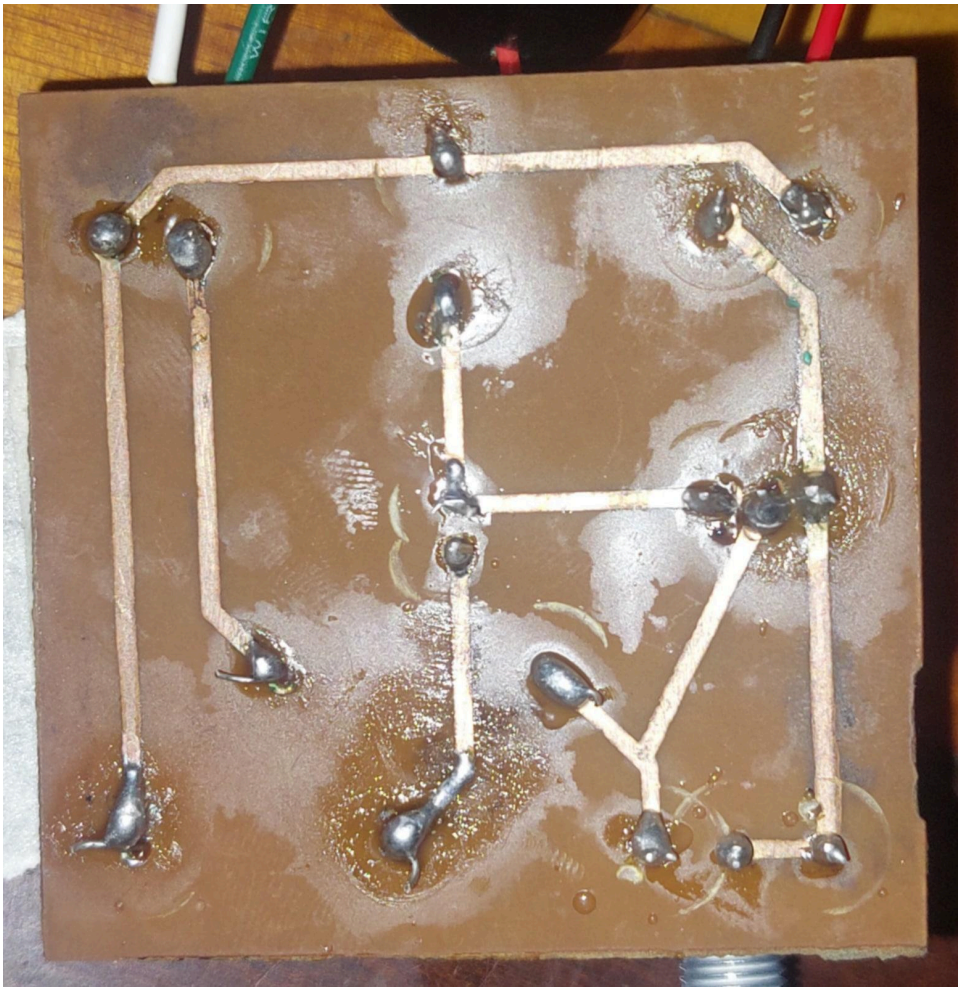
- **Easy Eda Circuit PCB**



- **Front Side View (Components)**



- **Back Side View (Circuit Diagram)**



VIDEO LINK DEMO: **Prelim Skills Exam DEMO.mp4**

- **Output:** **Prelim Skills Exam OUTPUT.mp4**
- **Conclusion:** I concluded that this prelim skills exam tested my capability this summer term by challenging me to create my own continuity tester from start to finish. I designed the circuit diagram schematic, converted it to a PCB layout, and etched it onto an actual PCB using the flattening iron method. After drilling the necessary holes with a mini drill, I inserted and soldered the components, which included an LED for visual indication, a piezo buzzer for audible alerts, a 2N3904 transistor for signal amplification and switching, 390Ω and 1kΩ resistors for current limiting and protection, a 50kΩ potentiometer for adjustable control, test probes for accurate measurement, and a 9V battery as the power source. This project allowed me to apply my knowledge of fundamental electronics and hands-on PCB fabrication, strengthening my practical skills and providing a solid foundation for more advanced projects in the future.

7. Assessment Rubric:

Circuit Output Grading Rubric

Criteria	Ratings				Pts
Circuit Design	**20 pts** **Excellent** Clear, logical, optimized layout; minimal trace crossings; adheres to design standards.	**15 pts** **Good** Mostly clear; some minor inefficiencies or unnecessary crossings	**10 pts** **Fair** Layout has issues; may be cluttered or inefficient.	**5 pts** **Poor/ Incomplete** Poorly planned; confusing or incomplete layout.	20 pts
Etching technique	**20 pts** **Excellent** Clean, precise etching; no under/over-etching; consistent trace width.	**15 pts** **Good** Minor flaws; slightly uneven or faint traces but functional.	**10 pts** **Fair** Noticeable imperfections; requires rework in spots.	**5 pts** **Poor/ Incomplete** Incomplete or heavily flawed; traces broken or unclear.	20 pts
Soldering Neatness	**20 pts** **Excellent** Solder joints are shiny, clean, and consistent; no bridges or excess solder.	**15 pts** **Good** Mostly neat; few cold joints or minor excess solder.	**10 pts** **Fair** Inconsistent joints; some cold soldering or minor bridging	**5 pts** **Poor/ Incomplete** Messy; frequent cold joints, bridging, or component damage	20 pts
Completeness of Components	**20 pts** **Excellent** All components correctly placed and oriented; fully populated board.	**15 pts** **Good** One or two components missing or misplaced.	**10 pts** **Fair** Several components missing, misplaced, or improperly oriented	**5 pts** **Poor/ Incomplete** Many missing/wrong components; significant errors.	20 pts
Functionality	**20 pts** **Excellent** Circuit performs all intended functions correctly and reliably.	**15 pts** **Good** Mostly functional; minor performance issues or instability.	**10 pts** **Fair** Partially functional; one or more major issues.	**5 pts** **Poor/ Incomplete** Not functional; does not perform intended tasks.	20 pts

Total Points: 100