Troubleshooting

FLOWCHARTS AND THE TROUBLESHOOTING PROCESS

1. Overview

Whether you are taking a course in electrical maintenance, mechanical maintenance, fluid power, automation, process control, robotics, or PLCs, you will undoubtedly have to **troubleshoot** at one time or another. Troubleshooting is a systematic approach to solving a problem, such as a fault in a mechanical or electrical system, or a bug in a computer program. Having an efficient and methodical way of resolving problems can help, and a **troubleshooting flowchart** is a good way to get started.

Troubleshooting flowcharts help technicians plot out steps to diagnose a problem by looking at **symptoms** and identifying possible causes. It is a visual representation of the steps taken to locate, rule out, repair, or escalate an issue. Such charts are often found in user manuals.

By developing a troubleshooting flowchart during a planned repair, a technician will avoid repeating errors. Technicians may also be able to get to the root cause of equipment failures as they visualize and plan their next steps during the flowchart exercise. See the most common chart symbols below and the examples of how they are used to sequence and troubleshoot common household tasks.
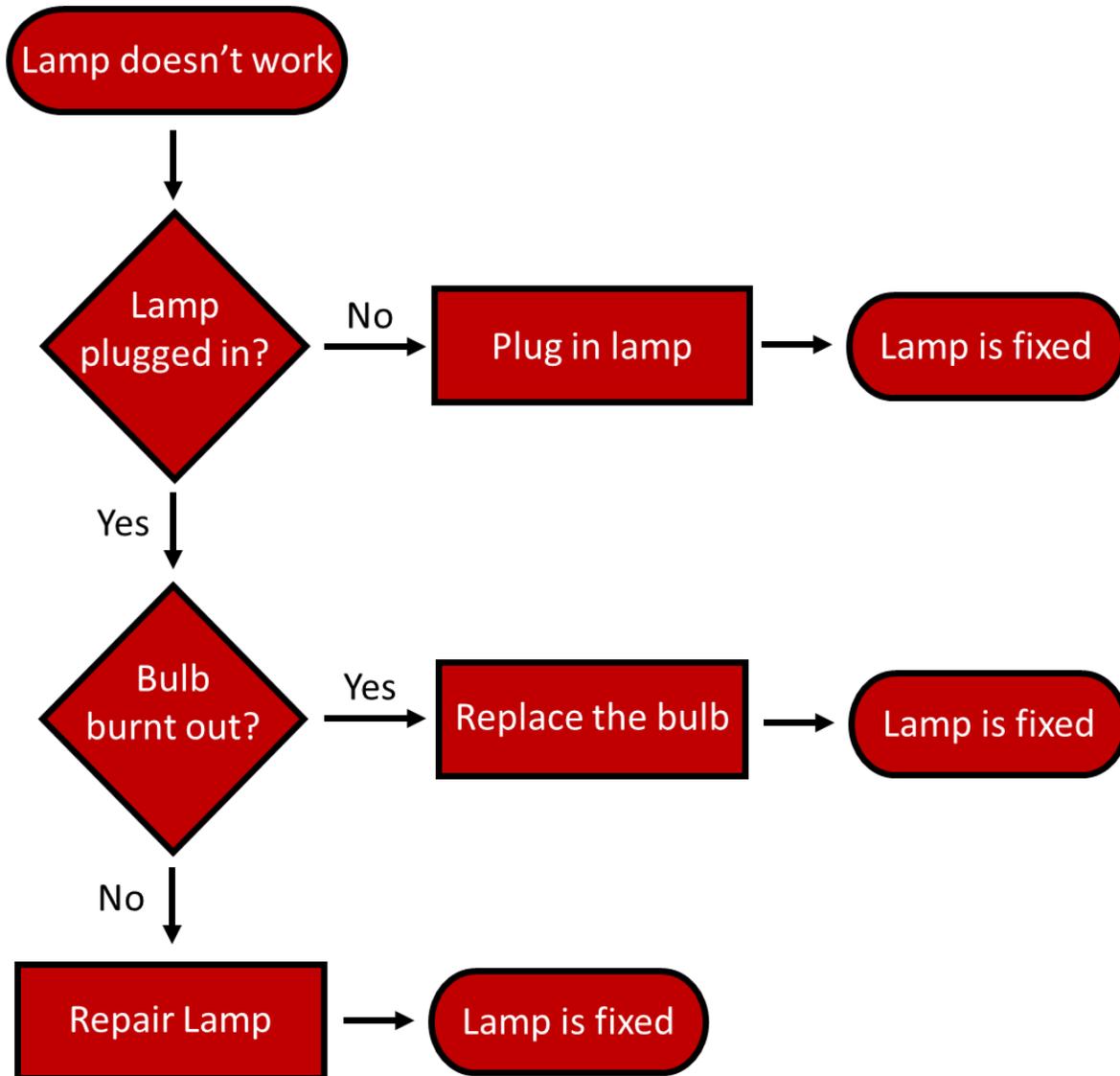
2. Basic Flowchart Symbols

These symbols are commonly used in flowcharts:

Symbol	Function
⬭	Start or end point
→	Connector - shows the relationship between the shapes
▱	Input or output
▭	Process
◆	Decision

3. Everyday Example

The first step in any troubleshooting process is to identify the *symptom*. In the case of a lamp not working, you would check to see if the lamp is plugged into a power outlet. If it is plugged into the power outlet, you would then proceed to check the bulb to see if it is burned out. You discover that the light bulb is indeed burned out. You proceed to change the bulb and, in doing so, resolve the problem with your lamp. The flowchart process for this scenario would look like the one shown below. Any additional (and concluding) step in the troubleshooting process would be to document the event.

```
Lamp doesn't work
      │
      ▼
  Lamp           No      Plug in lamp  →  Lamp is fixed
  plugged in?  ────────▶
      │
     Yes
      │
      ▼
  Bulb           Yes     Replace the bulb  →  Lamp is fixed
  burnt out?   ────────▶
      │
     No
      │
      ▼
  Repair Lamp  →  Lamp is fixed
```

4. General Troubleshooting Flowchart Process

The troubleshooting process used by technicians can be as complex as the systems they are working on, but the steps remain the same. While many experienced technicians can go through these steps automatically, a flowchart is a useful tool for complex problem solving and for ensuring that errors are not repeated. In industrial settings, technicians will ask questions such as:

1. **Power (electrical):** Does the machine power on? Are panel breakers tripped? Are panel fuses blown?

2. **Discovery:** What is the machine doing incorrectly or not doing? Has anything changed on the machine? Are there any error or fault messages? Is the manual available? Are schematics available? Which process is malfunctioning, and what components are associated with that process?

3. **Resolve / inspect the function of components:** Is it working? Is there an incoming signal? Is the component controlled by a relay? Is the component controlled by a process controller or PLC? Is it working electronically? Check drawings, schematics to repair components and/or fix or rewire any bad wiring.

4. **Repeat:** Repeat the troubleshooting cycle until the problem is resolved.

Technicians will follow a symptom and cause flowchart sequence like the one below. As you proceed through your lab exercises, you should practice using the flowchart process to sequence and troubleshoot problems that need to be fixed.
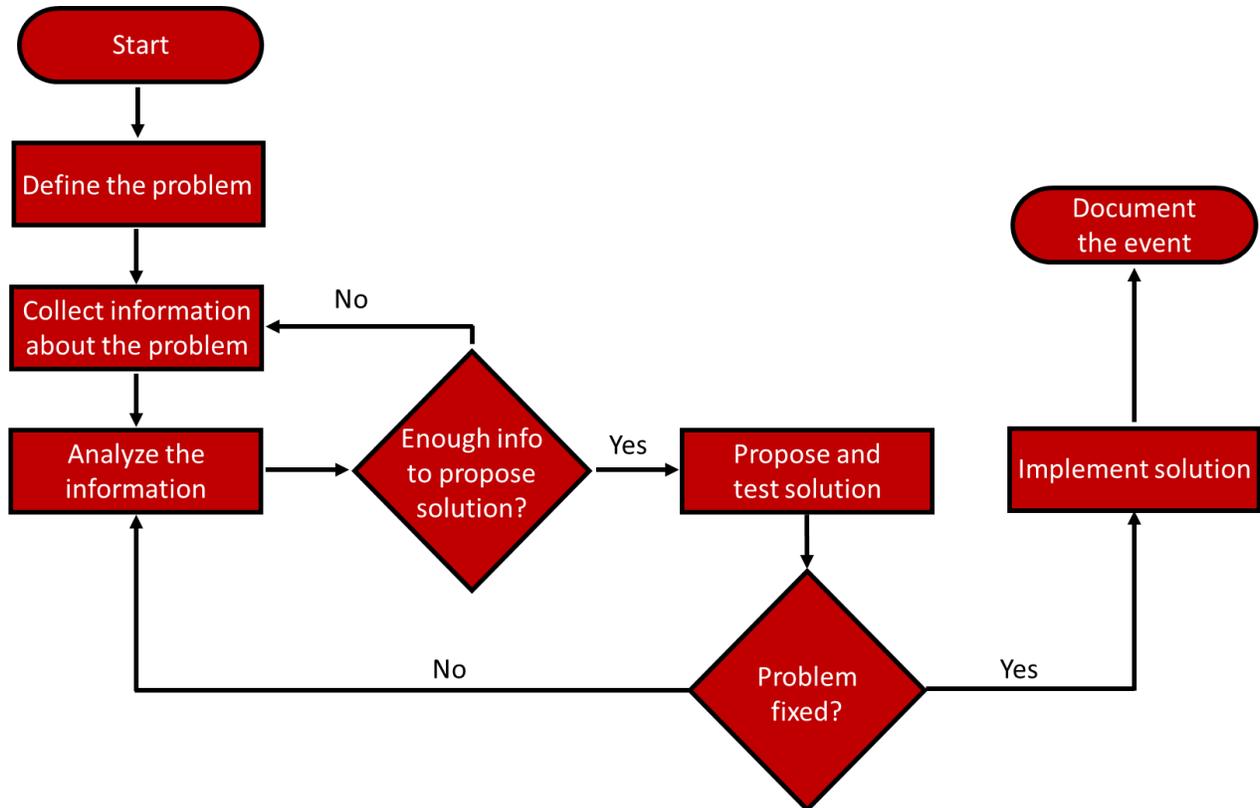
5. Review Questions

Answer the following questions to test your understanding of the flowchart method of troubleshooting.

1. In a flowchart, an oval represents:

    a. a solution.

    b. a relationship between items or events.

    c. a variable.

    d. the start or end of the flowchart process.

2. Diamonds in a flowchart represent:

    a. solutions.

    b. decisions.

    c. variables.

    d. the start or end of the flowchart process.

3. In a flowchart, a parallelogram represents:

    a. a solution.

    b. a decision.

    c. inputs or outputs.

    d. the start of the flowchart process.

4. The arrows in a flowchart:

    a. are connectors that illustrate the relationships between the shapes.

    b. show where decisions are made.

    c. indicate outputs.

    d. are the start of the flowchart process.

5. In troubleshooting flowcharts, rectangles represent:

    a. solutions

    b. decisions

    c. processes

    d. conclusions

6. The final step of the troubleshooting process is to:

   a. lock out and tag out the power source.

   b. notify the supervisor.

   c. document the event.

   d. clean up the workstation.

Answers: 1:d, 2:b, 3:c, 4:a, 5:c, 6:c

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