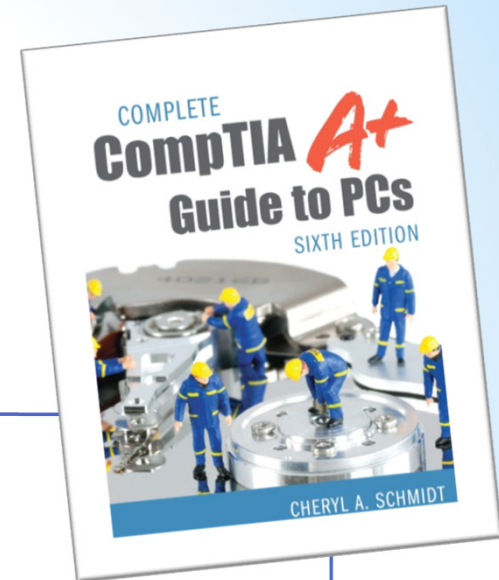


Chapter 5: Logical Troubleshooting



Complete CompTIA A+ Guide to PCs, 6e

CompTIA A+ Exam Objectives Covered in This Chapter

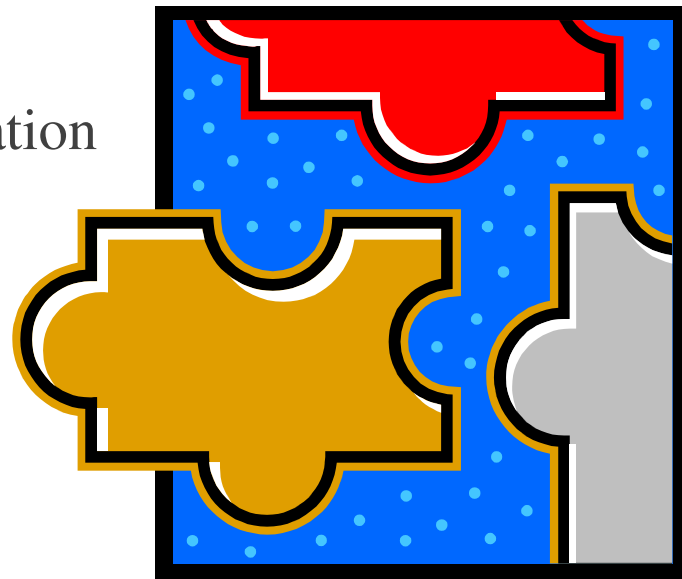
801-5.3: Given a scenario, demonstrate proper communication and professionalism.

802-4.1: Given a scenario, explain the troubleshooting theory.

802-4.2: Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.

Chapter Objectives

- How to perform basic troubleshooting procedures
- How BIOS controls the boot sequence and how that might help in troubleshooting
- The purpose of POST error codes
- The importance of good communication



Troubleshooting Overview

When a computer does not work properly, technicians must exhibit one essential **trait—the will to succeed**.

When a computer is down, a business loses revenue and productivity – therefore solving a problem quickly and with the least amount of downtime is a critical component of user support.

Therefore, a technician must:

- have a good attitude and a large amount of perseverance and drive to resolve the problem at hand quickly and efficiently, in a professional, helpful manner.
- must use all available resources -resources can be documentation for a particular peripheral, motherboard, or computer; the Internet; your five senses; another technician; corporate documentation; textbooks; experience with similar problems; training materials; previous service history on a particular customer/computer; or an online database provided by a company or partner.

6 Troubleshooting Steps

Solving a computer problem is easier if a technician uses reasoning and takes logical steps.

Logical troubleshooting can be broken down into the following **six simple steps**:

1. Identify the problem.
2. Establish a theory of probable cause (question the obvious).
3. Test the theory to determine the cause.
4. Establish a plan of action to resolve the problem and implement the solution.
5. Verify full system functionality and, if applicable, implement preventive measures.
6. Document findings, actions, and outcomes.

Back Up Data if Possible



Before any changes are made to a system,
ensure that its data is backed up if possible.

Identify the Problem

Do not assume anything; ask the user to re-create the problem step-by-step.

Ask the user if anything has been changed. Do not be threatening; otherwise, the user will not be forthright and honest. Use open-ended questions to get an idea of what is wrong. Use closed-ended questions to narrow the problem.

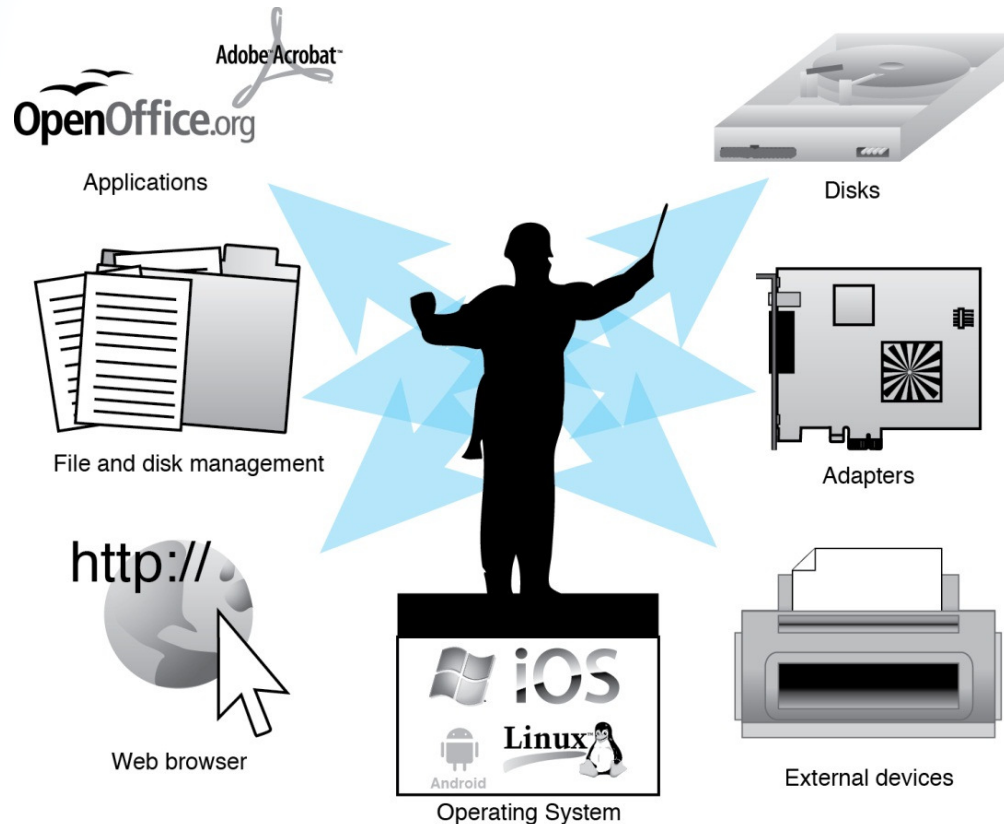
Verify obvious things such as power to the monitor or speakers muted through the Control Panel.

Do not assume that there is not a problem if the user cannot re-create it. Some problems occur intermittently.

Back up data, if possible, before making changes.

Use all your senses. Listen for noises such as from the power supply, case/CPU fans, or hard drive. Power off if you detect a burning smell.

Establish a Theory of Probable Cause



Analyze the problem and determine whether the problem is hardware or software related (or both).

Often a Hardware Problem Is Detected During POST

Knowing the steps taken during the boot process helps you troubleshoot:

1. The power supply sends a **power good signal**.
2. The CPU looks in BIOS for software.
3. The CPU executes POST from BIOS. Note that any errors are usually **audio** or motherboard **LEDs** or **codes** at this point.
4. System resources (I/O address, memory addresses, and interrupts) are retrieved from NVRAM (nonvolatile RAM or RAM that can be changed, but data is not lost when power is removed) and assigned to ports, devices, and adapters.
5. Video is initialized, and a cursor appears.
6. POST continues to check hardware and error messages and/or codes can now appear on the display.
7. Based on the boot order configuration in System Setup, the system checks for an operating system from the specified devices.
8. On the first device found that contains an operating system, the operating system loads.

AMI BIOS audio beeps

Beeps	Description of problem
1, 2, or 3	Memory error
4, 5, 6, or 7	Motherboard component
8	Video issue

- The number or duration of beeps and the numeric error codes that appear are different for different computers.
- The secret is knowing the BIOS chip manufacturer.
- The computer or motherboard documentation sometimes contains a list of codes or beeps used for troubleshooting.

A single beep is a common tone heard on a successful completion of POST because no hardware errors were detected.

Phoenix audio beep codes

Beeps	Description
1-2-2-3	BIOS ROM (flash the BIOS/motherboard)
1-3-1-1	Memory refresh (RAM contacts/RAM)
1-3-1-3	8742 keyboard controller (keyboard/motherboard)
1-3-4-1	Memory address line error (RAM contacts/RAM/power supply/motherboard)
1-3-4-3	Memory error (RAM contacts/RAM/motherboard)
1-4-1-3	CPU bus clock frequency
2-2-3-1	Unexpected interrupt (adapter/motherboard)
2-4-2-3	Keyboard error
3-1-1-1	Onboard I/O port issue

Written BIOS POST error messages



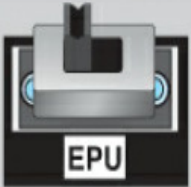



Message	Description
BIOS ROM checksum error—System halted	The BIOS has a problem and needs to be replaced.
CMOS battery failed/error	Replace the motherboard battery.
CMOS checksum error—Defaults loaded	CMOS has detected a problem. Check the motherboard battery.
CMOS timer error	The system date/time has not been set. Check/replace the motherboard battery if this is not the first time this computer has been powered on.
Floppy disk(s) failed	The system has been configured to have a floppy disk installed and the drive has not responded. Check the drive connectivity and power. If no drive is installed, change the setting in BIOS Setup.
Hard disk install failure	The BIOS could not find or initialize the hard drive. Check the hard drive connectivity and power.
Intruder detection error	The computer chassis has been opened.
Keyboard error or no keyboard present	The keyboard could not be found. Check the cabling.
Keyboard is locked out—Unlock the key	Ensure that nothing rests on the keys during the POST.
Memory test fail	A RAM error occurred. Swap the memory modules.
Memory size decrease error	The amount of system RAM has decreased. Check to see if RAM has been stolen, needs reseating, or needs to be replaced.
Memory optimal error	The amount of memory in channel A is not equal to channel B. For optimal memory performance they should be equal.
Override enabled—Defaults loaded	The current settings in CMOS could not be loaded, and the BIOS defaults are used. Check the battery and CMOS settings.
Primary master hard disk fail	The PATA hard drive attached to the primary IDE connector and configured as master could not be detected. If a new installation, check the cabling, power, and master/slave/cable select settings. See Chapter 7 for more details.
Primary slave hard disk fail	The PATA hard drive attached to the primary IDE connector and configured as slave could not be detected. If a new installation, check the cabling, power, and master/slave/cable select settings. See Chapter 7 for more details.
Secondary master hard disk fail	The PATA hard drive attached to the secondary IDE connector and configured as master could not be detected. If a new installation, check the cabling, power, and master/slave/cable select settings. See Chapter 7 for more details.
Secondary slave hard disk fail	The PATA hard drive attached to the secondary IDE connector and configured as slave could not be detected. If a new installation, check the cabling, power, and master/slave/cable select settings.

A BIOS can be sold to various computer manufacturers, who are allowed to create their own error codes and messages.

Look in the motherboard/ computer manual or on the manufacturer's website for a list of exact error messages.

Examples of Motherboard Switches and LEDs

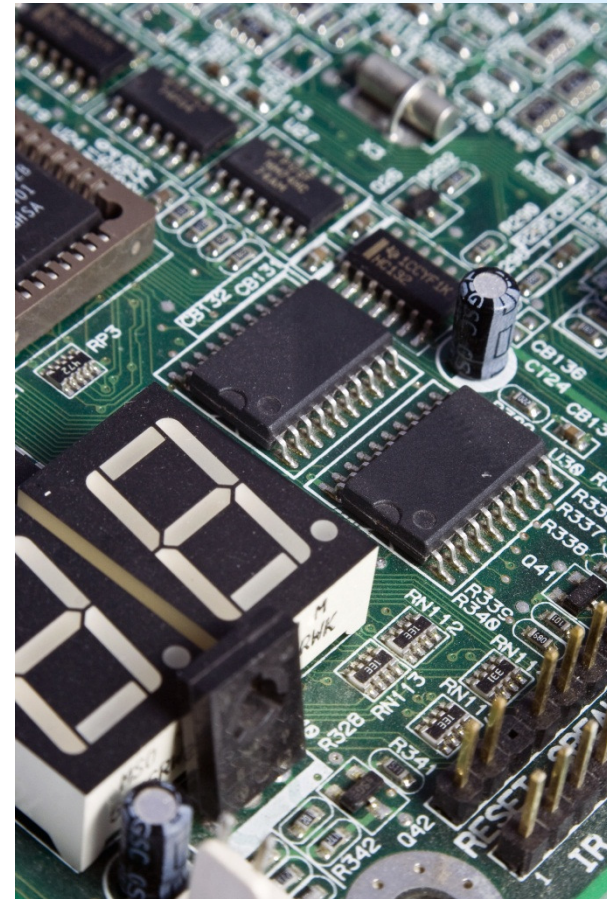
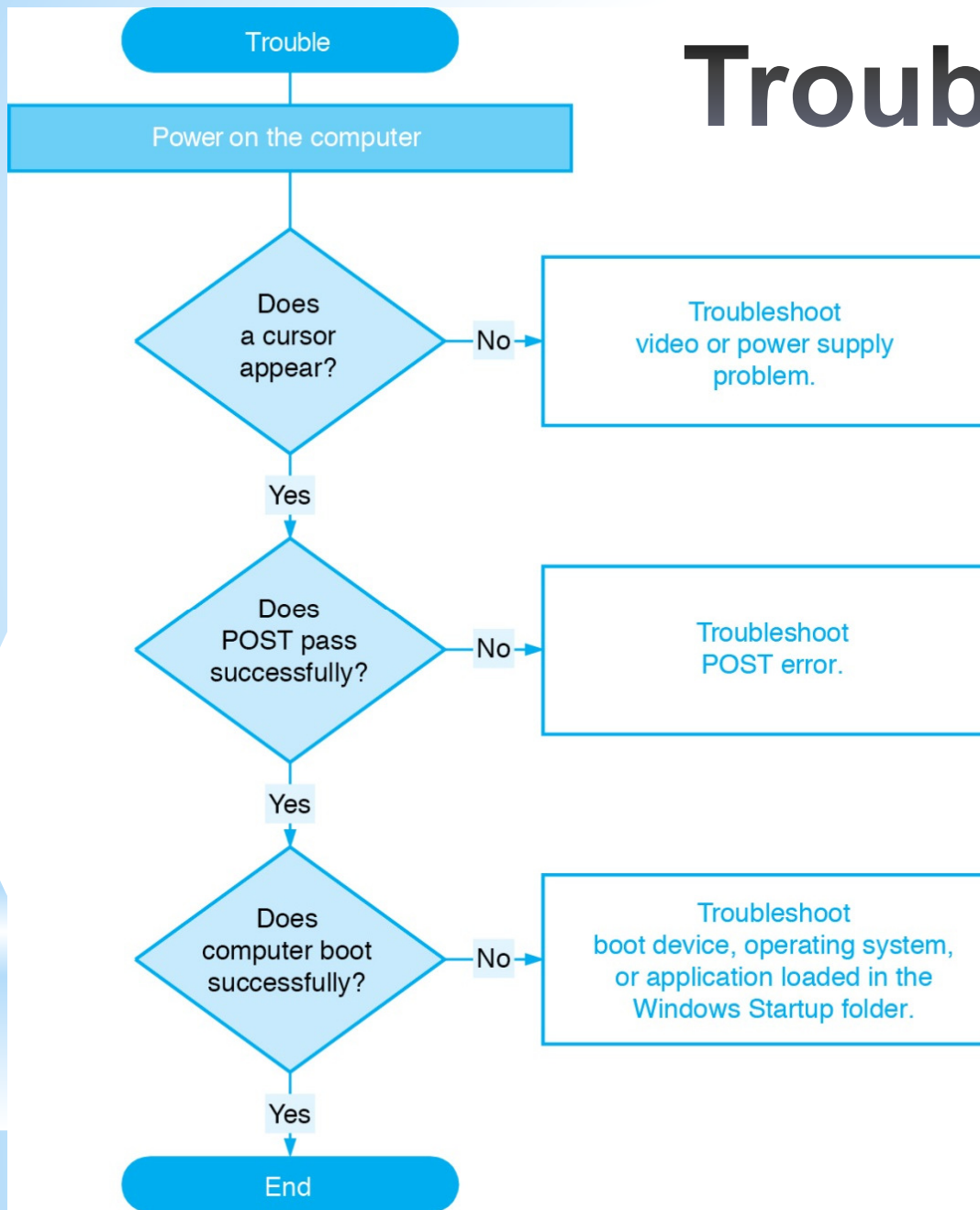


Switch	LED	Explanation
	 MemOK	Depress the MemOK switch to determine if the RAM modules are compatible. The MemOK LED illuminates if so.
	 EPU	Enable the EPU switch or enable through BIOS to allow the motherboard to moderate power consumption. When enabled, the EPU LED is lit.
	 RAM	The RAM LED illuminates for a memory error.
	 Power	The power LED commonly illuminates when power is applied, or if the computer is in either the sleep or soft off power mode.

Software errors occur when a computer user accesses a particular application or file or when the system boots.

- Sometimes the problem can be resolved with a **warm boot**.
- Every software program has problems (bugs). Software manufacturers offer a **software patch** or a **service release** that fixes known problems.
- Patches or service releases are usually available on the Internet from the software manufacturer.
- A **service pack** usually contains multiple patches and installs them at the same time rather than in multiple downloads.

Troubleshooting



Test the Theory to Determine Cause

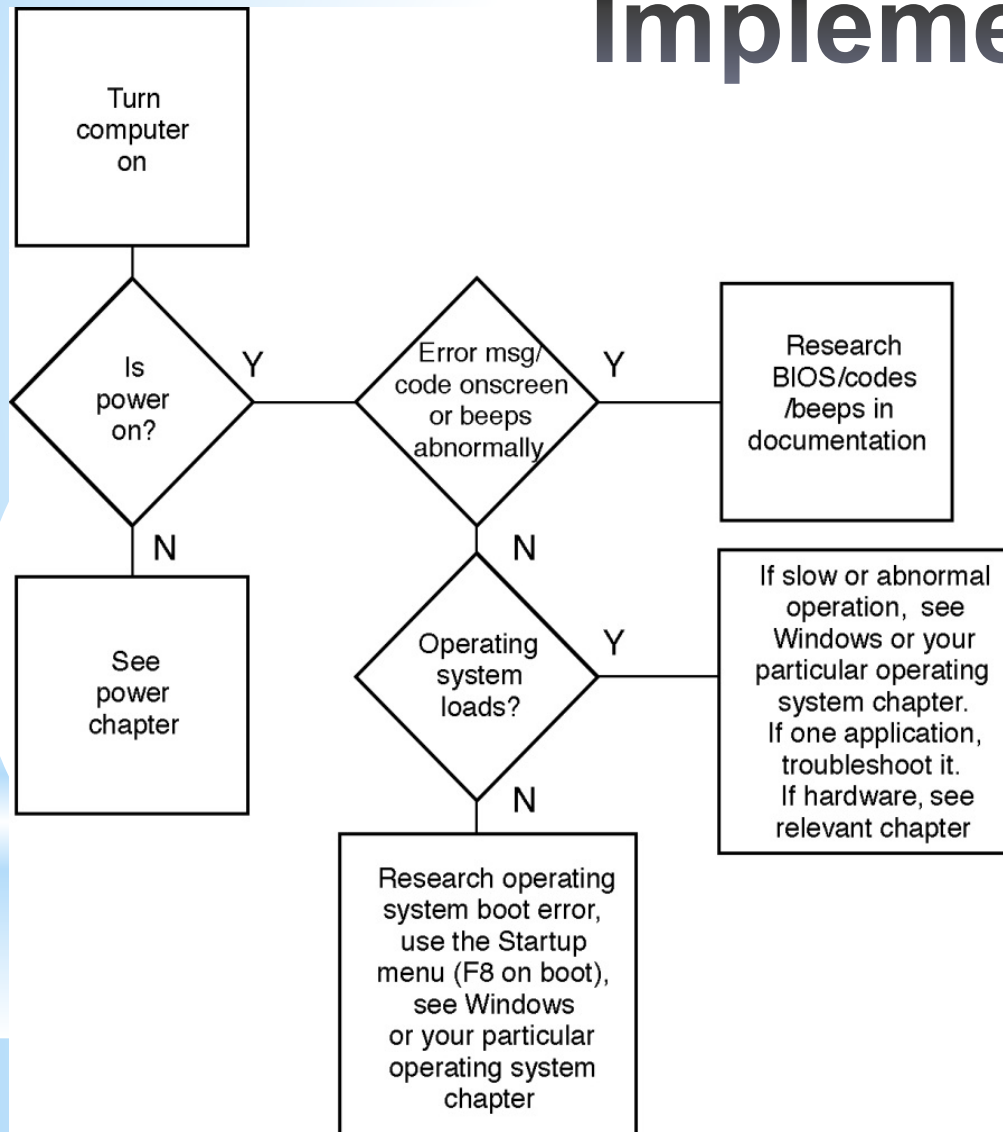
Divide the problem into logical areas and continue subdividing the problem until it is isolated.

Isolating a problem frequently requires part swapping. Return the original part if a new part does not fix the problem. Then continue troubleshooting.

Software problems frequently involve reloading software applications and software drivers or getting software updates and patches from the appropriate vendor.

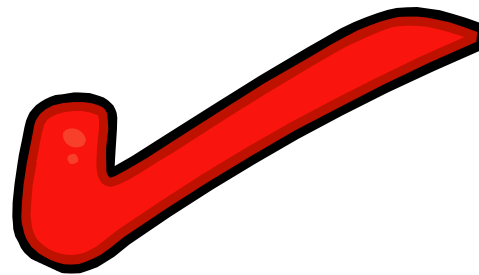
If swapping a part or reloading the software does not solve the problem, go back to logical troubleshooting.

Establish a Plan of Action and Implement the Solution



- The plan of action should take you through resolving the problem and implementing the solution.
- Some repairs take multiple steps.
- Having a plan instead of just doing things in a random order saves time, and time is money!

Verify Full System Functionality and Implement Preventive Measures



Never assume that a hardware component or the replaced software repairs a computer. The computer can have multiple problems, or one repair may not offer a complete solution. Verify full system functionality and have the user test the computer in normal conditions to prove that the problem is indeed solved.

Document Findings, Actions, and Outcomes

Always document a problem as part of the troubleshooting process and provide feedback to the user.



Soft Skills – Documentation and Feedback

Documenting the steps taken to resolve a problem in a clear, concise manner is important.

Having easy-to-read and easy-to-understand documentation is important for nontechnical users who see this documentation as well as any follow-up repairs that you or another technician must do.

A repair is never finished until the user or customer is informed.

Follow up with the customer one week after the repair to make sure the customer is satisfied and that the problem is solved.

Keep in mind that the general rule of thumb is that if the customer is satisfied, he or she will tell 1 or 2 other people about the service. If the customer is dissatisfied, he or she will tell 10 other people about the problem.

A+ Certification Exam Tips

Review the troubleshooting steps. Even though you might think logically, when put in written questions, these can be tricky. Try to think of the computer problems you solved during the chapter activities. Now relate those steps to the six troubleshooting steps. This will help you remember when you take the 220-802 exam. The six troubleshooting steps could be applied to specific troubleshooting scenarios.

Review the boot process order and procedures. Knowing this list and the order in which things happen can help you with troubleshooting questions that may appear on the exams.

If you know any technicians, ask them to tell you the problems they solved this week. Another idea is to get them to tell you a problem, and you see if you can guess the top things that could cause that problem.

Review the short customer support/soft skills section for the best practices in communication skills. The communication questions can sometimes have answers that are very similar. Use the review questions at the end of the chapter to help practice with those types of questions.

Chapter Summary

- The six steps of troubleshooting are as follows: (1) Identify the problem, (2) establish a theory, (3) test the theory, (4) establish a plan of action, (5) verify full system functionality and, if applicable, implement preventive measures, and (6) document findings, actions, and outcomes as well as provide feedback.
- BIOS controls the boot process. Knowing the following steps can help with the troubleshooting process. The basic steps that the computer goes through to start up are as follows:
 1. Power good signal is sent from power supply.
 2. CPU looks in BIOS for software.
 3. The CPU executes the POST (only audio errors available at this point).
 4. Computer assigns system resources to ports, devices, and adapters.
 5. Computer initializes video—a cursor appears.
 6. POST continues checking hardware.
 7. Computer looks for an operating system from the specified boot order devices.
 8. Computer loads the operating system or halts with an error.

Chapter Summary

- POST error codes are determined by the BIOS vendor and the company that makes the motherboard.
- POST codes can be audible beeps, numeric codes, or words.
- The BIOS can contain advanced diagnostics.
- The motherboard can contain diagnostic LEDs or a display.
- A POST card can be used to perform diagnostics.
- A loopback plug can be used in conjunction with diagnostics to check older ports or test network interface ports.
- Reinstall parts that do not solve the problem.
- Always document a problem as part of the troubleshooting process. Give users the appropriate documentation. Be professional in your oral and written communication. Provide feedback to the user.