

# **FUTM-CPT 122: Introduction to Computer Hardware Systems and Maintenance**

**Module 4:           Computer Maintenance**

**Unit 1:           Computer Maintenance Basics**

**Unit 2:           Troubleshooting and Repair**

# Module 4

---



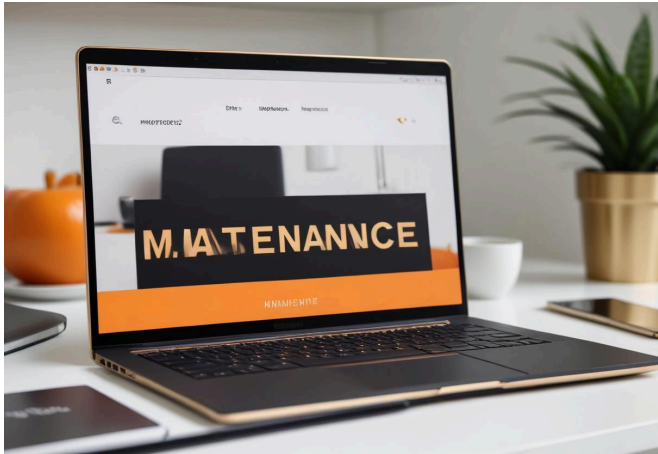
## Computer Maintenance

**Unit 1:**            **Computer Maintenance Basics**

**Unit 2:**            **Troubleshooting and Repair**

# Unit 1

---



## Computer Maintenance Basics

### Contents

- 1.0 Introduction**
- 2.0 Learning Outcomes**
- 3.0 Learning Contents**
  - 3.1 Introduction to Computer Maintenance**
  - 3.2 Components Requiring Regular Inspection**
  - 3.3 Steps for Regular Computer Maintenance**
- 4.0 Conclusion**
- 5.0 Summary**
- 6.0 Tutor-Marked Assignment (TMA)**

## **1.0 Introduction**

Computer maintenance refers to the physical processes of upkeep of the peripherals. Maintenance activities like regular brushing, dusting, vacuum cleaning, etc. are important but mostly ignored preventive measures. Regular maintenance generally handles most of the problems, especially data loss or corruption. So it should be given due importance.

## **2.0 Learning Outcomes**

In this unit, you will:

- Understand the Importance of Computer Maintenance
- Know the different types of maintenance
- Perform regular inspections of computer components

By the end of this unit, you will have a solid understanding of how to maintain your computer for optimal performance, longevity, and reliability.

## **3.0 Learning Contents**

### **3.1 Introduction to Computer Maintenance**

Computers, like any other commodity, demand proper maintenance. Everyone must take the desired steps every couple of weeks so that their computer remains in good condition.

#### **3.1.1 Importance of Computer Maintenance**

Computer maintenance is important for several reasons, including:

##### **3.1.1.1 Optimal Performance**

Regular maintenance helps ensure that your computer runs smoothly and efficiently. This includes tasks such as disk defragmentation, deleting temporary files, and updating software, which can help improve the overall performance of your system.

### **3.1.1.2 Preventing System Failures**

You can identify potential issues before they escalate into major problems by conducting routine maintenance tasks. This can help prevent system crashes, data loss, and hardware failures.

### **3.1.1.3 Security**

Keeping your computer up-to-date with the latest antivirus software and security patches is crucial for protecting your data and privacy. Regular maintenance can help ensure that your system is secure against cyber threats.

### **3.1.1.4 Longevity**

Proper maintenance can extend the lifespan of your computer by preventing wear and tear on hardware components. By keeping your system clean and well-maintained, you can minimise the risk of hardware failures and prolong the life of your device.

### **3.1.1.5 Data Backup**

Regular maintenance often includes backing up important data, which is essential for protecting against data loss in the event of system failures or malware attacks. Scheduled backups can help you recover your files in case of emergencies.

## **3.1.2 Types of Computer Maintenance**

Computer maintenance is essential to ensure that both hardware and software components of a computer system function efficiently and effectively. There are two main types of computer maintenance: preventive maintenance and corrective maintenance. Each type serves a different purpose and involves specific tasks and procedures.

### **3.1.2.1 Preventive Maintenance**

Preventive maintenance involves routine actions and checks to prevent potential problems before they occur. It is proactive and aims to keep the computer system in good working condition by minimising the likelihood of hardware failures, software

issues, and system downtime. Preventive maintenance can be further divided into system-level maintenance and physical-level maintenance.

#### **3.1.2.1.1 System-Level Maintenance**

System-level maintenance focuses on the software aspects of the computer system. It includes tasks that ensure the operating system, applications, and security measures are up-to-date and functioning correctly. Key tasks include:

1. **Software Updates:** Regularly update the operating system, device drivers, and applications to the latest versions. Updates often include security patches, bug fixes, and performance improvements.
2. **Antivirus and Security Scans:** Performing regular scans with antivirus and anti-malware software to detect and remove potential threats. Ensuring that security software is up-to-date.
3. **Disk Cleanup:** removing unnecessary files, such as temporary files, cache, and unused programs, to free up disk space and improve system performance.
4. **Disk Defragmentation:** For hard disk drives (HDDs), defragmenting the disk helps to reorganise fragmented data and improve read/write efficiency. Solid-state drives (SSDs) do not require defragmentation but may benefit from optimization tools.
5. **System Backups:** Regularly back up important data to an external drive or cloud storage to prevent data loss in case of hardware failure or other issues.

#### **3.1.2.1.2 Physical-Level Maintenance**

Physical-level maintenance focuses on the hardware components of the computer system. It involves cleaning, inspecting, and testing hardware to ensure it operates correctly and efficiently. Key tasks include:

1. **Cleaning:** using compressed air to remove dust and debris from internal components such as the motherboard, power supply, fans, and heat sinks. Cleaning external surfaces, screens, and peripherals with appropriate cleaning solutions.
2. **Inspection:** Regularly checking for loose cables, secure connections, and signs of wear or damage on hardware components. Ensuring that

components such as RAM, graphics cards, and storage devices are properly seated and connected.

3. **Cooling System Maintenance:** ensuring proper airflow within the computer case by cleaning fans and heat sinks, and replacing thermal paste if necessary. Check that the cooling system is functioning correctly to prevent overheating.
4. **Peripheral Maintenance:** inspecting and cleaning peripherals such as keyboards, mice, printers, and monitors to ensure they operate smoothly.

### 3.1.2.2 Corrective Maintenance

Corrective maintenance involves actions taken to fix issues and restore normal operations when problems arise. It is reactive and aims to address specific issues that have already occurred, such as hardware failures, software errors, or system malfunctions. Key tasks include:

#### 3.1.2.2.1 Hardware Repairs

1. **Component Replacement:** Replacing faulty hardware components such as RAM, hard drives, power supplies, or graphics cards. Ensuring that replacement parts are compatible with the system.
2. **Connection Repairs:** Reseating loose cables and connections, and replacing damaged cables or connectors.
3. **Diagnostic Testing:** Running hardware diagnostics to identify the root cause of issues and verify that repairs have resolved the problem.

#### 3.1.2.2.2 Software Repairs

1. **Software Reinstallation:** Reinstalling operating systems, device drivers, or applications that are experiencing issues. This may involve using recovery media or downloading software from the manufacturer's website.
2. **System Restore:** Using system restore points to revert the computer to a previous state where it was functioning correctly. This can help resolve software issues caused by recent changes or updates.
3. **Error Resolution:** diagnosing and fixing specific software errors, such as resolving conflicts, repairing corrupted files, or adjusting settings to restore functionality.

### **3.1.2.2.3 Data Recovery**

1. **Data Retrieval:** Recovering lost or corrupted data using data recovery tools or services. This may involve restoring data from backups or using specialised software to retrieve data from damaged drives.
2. **File Repair:** Repairing or recovering corrupted files to restore access to important data.

## **3.2 Components Requiring Regular Inspection**

Regular inspection of various components in a computer is essential to maintaining its optimal performance and preventing potential issues. Here are some components that require regular inspection:

### **3.2.1 Hardware Components**

#### **3.2.1.1 Motherboard**

Inspect the motherboard for dust buildup, proper seating of components, and bulging or leaking capacitors, which can indicate a potential hardware failure. Also, check for loose connections or damaged components.

#### **3.2.1.2 Power Supply Unit (PSU)**

Check the PSU for any visible damage or signs of wear. Ensure proper ventilation and test the power output using a multimeter to ensure it is providing consistent and stable power to the components.

#### **3.2.1.3 Cooling System**

Check the fans inside the computer, including the CPU fan, case fan, and power supply fan, for dust buildup. Clean the fans regularly to prevent overheating, ensure proper airflow and replace thermal paste if necessary.

#### **3.2.1.4 Hard Drive**

Regularly check the health and performance of the hard drive using diagnostic tools. Monitor for signs of potential failure, such as strange noises, slow performance, or



file corruption. Also, defragment hard drives (HDDs) and ensure solid-state drives (SSDs) are not overfilled.

#### **3.2.1.5 RAM**

Test the RAM using tools like MemTest86 to identify any issues with memory modules that could cause system instability or crashes.

#### **3.2.1.6 Cables and Connections**

Regularly check all cables and connections to ensure they are securely plugged in and not damaged. Loose connections can cause intermittent issues or hardware failures.

### **3.2.1 Software Components**

#### **3.2.1.1 Operating System Updates**

Frequently check for and install operating system updates to tackle security vulnerabilities, enhance performance, and introduce new features. This applies to updating Windows, macOS, or Linux distributions.

#### **3.2.1.2 Application Updates**

Consistently update your software applications to patch security vulnerabilities, resolve bugs, and enhance functionality. This pertains to productivity tools, multimedia software, and other third-party applications. Additionally, assess compatibility concerns and uninstall unused programs.

#### **3.2.1.3 Antivirus Software**

Make sure your antivirus software and firewall are up to date, and regularly scan to identify and eliminate any malware threats that could jeopardise your system's security. This will safeguard your computer against unauthorised access and potentially harmful network traffic.

## **3.3 Steps for Regular Computer Maintenance**

### **3.3.1 Hardware Maintenance**

Regular hardware maintenance is essential to keep your computer running smoothly and prevent any potential issues. Here are some steps for regular hardware maintenance:

#### **3.3.1.1      Clean the exterior**

Turn off your computer and unplug it. Use a soft, lint-free cloth to wipe down the exterior of the computer, including the keyboard, mouse, and monitor.

Did you know that researchers have found that the average desktop and keyboard are dirtier than a toilet seat? That's why dusting your keyboard off at least once a week can help maintain it (and reduce health risks). Wipe down your keyboard with a damp, lint-free cloth, but be sure not to soak it in water. For harder-to-reach areas, such as in between the keyboard keys, use a compressed air canister.

Fingerprints and other stains can appear regularly on your monitor. To keep your screen view fresh and clean, wipe down your monitor once a week using a dry, lint-free cloth. Gently wipe in long motions, as pressing too hard can damage your device. Oftentimes, your computer will come with a microfiber cleaning cloth upon purchase. Use this cloth or order a similar one for optimal cleaning.

#### **3.3.1.2      Dust the interior**

Dust can accumulate inside your computer, causing it to overheat. Use a can of compressed air to carefully blow out dust from the vents, fans, and other components inside the computer. Be sure to hold the fans in place while blowing out the dust to prevent them from spinning too fast.

#### **3.3.1.3      Check cables and connections**

Make sure all cables are securely plugged in and not damaged. Check the connections for your keyboard, mouse, monitor, and any other peripherals.

#### **3.3.1.4      Check for hardware issues**

Monitor your computer for any signs of hardware issues, such as strange noises, overheating, or performance problems. If you notice any unusual behaviour, consider seeking professional help to diagnose and fix the issue.

#### **3.3.1.4 Defragment your hard drive**

Defragging is the process of reorganising the data on your hard drive to speed up file access. It breaks up a file into smaller bits on your device.

If you are using a traditional hard drive (not an SSD), consider defragmenting it to optimise its performance. You can use the built-in disk defragmenter tool in Windows or a third-party defragmentation tool.

#### **3.3.1.5 Update software**

Regularly check for and install updates for your operating system, drivers, and software programs. These updates often contain bug fixes and security patches that can help improve the performance and security of your computer.

#### **3.3.1.6 Run disk cleanup**

Use the built-in disk cleanup tool in your operating system to remove temporary files, cache files, and other unnecessary data that can take up space and slow down your computer.

### **3.3.2 Software Maintenance**

Regular software maintenance is crucial for ensuring that your software remains efficient, secure, and up-to-date. Here are some steps for regular software maintenance:

#### **3.3.2.1 Patch Management**

Regularly check for and apply software patches and updates provided by the software vendors. This helps in addressing any security vulnerabilities and improving the overall performance of the software.

#### **3.3.2.2 Security Audits**

Conduct regular security audits to identify and address any weaknesses in the software. This helps in ensuring that the software is protected against potential cyber threats.

### **3.3.2.3 Backup and Recovery**

Implement a regular backup and recovery plan to prevent data loss in case of system failures or cyber-attacks. Regularly test the backups to ensure that they are working effectively.

### **3.3.2.4 Performance Monitoring**

Monitor the performance of the software regularly to identify any issues or bottlenecks. This can help in optimising the software for better efficiency and user experience.

### **3.3.2.5 Compliance Checks**

Ensure that the software remains compliant with any relevant industry standards or regulations by conducting regular compliance checks and assessments.

## **4.0 Conclusion**

We have learned about computer maintenance, its benefits and its importance.

## **5.0 Summary**

In this unit, we covered the essentials of computer maintenance, emphasising the importance of regular upkeep to enhance performance, increase longevity, and ensure security. We explored different types of maintenance, including preventive and corrective, and detailed the steps for maintaining both hardware and software components.

## **6.0 Tutor-Marked Assignment (TMA)**

### **Question 1: Importance of Computer Maintenance**

Explain why regular computer maintenance is crucial for optimal performance and longevity. Provide examples of maintenance tasks that should be performed regularly.

**Question 2: Preventive Maintenance**

Describe the difference between system-level and physical-level preventive maintenance. List three tasks associated with each type.

**Question 3: Virus and Malware Prevention**

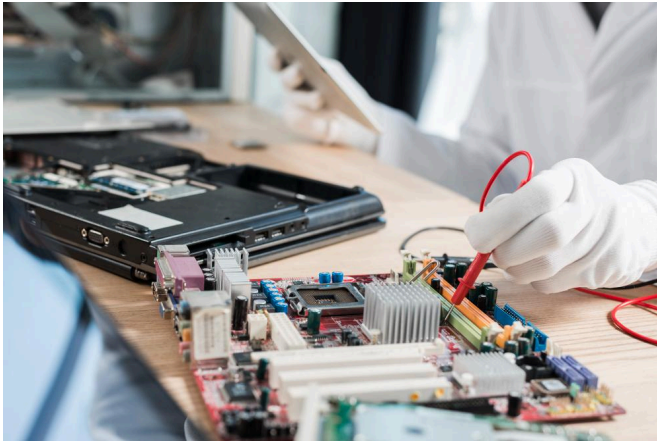
Discuss the steps you would take to prevent virus and malware infections on a computer system. How would you handle a situation where the system is already infected?

**Question 4: Troubleshooting Hardware Issues**

Describe a common hardware issue you might encounter in a computer system. Explain the steps you would take to diagnose and repair the issue.

# Unit 2

---



## Troubleshooting and Repair

### Contents

- 1.0 Introduction**
- 2.0 Learning Outcomes**
- 3.0 Learning Contents**
  - 3.1 Introduction to Troubleshooting**
  - 3.2 Diagnostic Tools**
  - 3.3 Repair Techniques and Best Practices**
- 4.0 Conclusion**
- 5.0 Summary**
- 6.0 Tutor-Marked Assignment (TMA)**

## **1.0 Introduction**

Troubleshooting and repair are critical skills for anyone responsible for maintaining computer systems. This Unit will cover systematic approaches to identifying, diagnosing, and resolving common hardware and software issues. Understanding these techniques will help you minimise downtime and keep systems running smoothly.

## **2.0 Learning Outcomes**

In this unit, you will be able to:

- Understand the Fundamentals of Troubleshooting
- Identify Common Hardware and Software Issues, utilise diagnostic tools and perform repairs

## **3.0 Learning Contents**

### **3.1 Introduction to Troubleshooting**

Troubleshooting is a systematic approach to problem-solving that is often used to find and correct issues with complex machines, electronics, computers and software systems. The first step in most troubleshooting methods is gathering information on the issue, such as an undesired behaviour or a lack of expected functionality.

Once the issue and how to reproduce it are understood, the next step is to eliminate unnecessary components to determine if the issue persists. This can help identify component incompatibility issues and problems caused by third-party products.

Troubleshooting methodologies usually try to isolate a problem so that it can be examined. The initial goal is to diagnose the problem and try obvious solutions, such as performing a system reboot, powering down and up, and checking that the power cord is connected.

Troubleshooters initially look for common, known causes. For example, when a laptop won't boot up, an obvious first step is to check whether the power cable is

working. Once common issues are ruled out, troubleshooters must run through a checklist of components to identify where the failure is happening.

The primary objectives of troubleshooting are to figure out why something doesn't work as intended and provide a solution to resolve the issue.

### **3.1.1 Common Hardware Issues and Solutions**

When dealing with computer systems, various hardware issues can arise. Understanding these common problems and knowing how to diagnose and resolve them is essential for maintaining system functionality. Below are detailed explanations of some prevalent hardware issues and their solutions.

#### **3.1.1.1 Power Issues**

##### **Symptoms**

- The computer does not power on, there are no lights or sounds, or there are intermittent power failures.

##### **Diagnosis**

- Check the power cable and ensure it is securely connected to both the computer and the power outlet.
- Test the power outlet with another device to confirm it is working.
- Use a multimeter to check the power supply unit (PSU) for proper voltage output.
- Look for any signs of damage or wear on the power cable and connectors.

##### **Solutions**

- Replace the power cable if it is faulty.
- Ensure the PSU switch (if available) is in the "on" position.
- If the PSU is defective, replace it with a compatible unit.
- Check and reseat the power connectors on the motherboard and other components.

#### **3.1.1.2 Overheating**

##### **Symptoms**



- The computer shuts down unexpectedly, there is high fan noise, the system becomes sluggish, there are thermal warnings, or there are blue screen errors.

### **Diagnosis**

- Check the temperature readings in the BIOS/UEFI or use monitoring software like HWMonitor or Core Temp.
- Inspect the internal components for dust buildup on fans, heat sinks, and vents.
- Ensure that all fans (CPU, case, and GPU) are spinning and not obstructed.
- Verify that the thermal paste between the CPU and heat sink is applied correctly.

### **Solutions**

- Clean dust and debris from all cooling components using compressed air.
- Reapply thermal paste to the CPU if it has dried out or is improperly applied.
- Ensure proper airflow by arranging cables neatly and leaving enough space around the computer for ventilation.
- Add or replace case fans to improve airflow.
- Check for BIOS updates that might address thermal management issues.

#### **3.1.1.3 Memory Issues**

### **Symptoms**

- The computer crashes or freezes frequently, there are blue screen errors (BSOD), the system fails to boot, or beeping sounds during startup.

### **Diagnosis**

- Run memory diagnostic tools like Windows Memory Diagnostic or MemTest86.
- Inspect the RAM modules for physical damage or improper seating.
- Test each RAM module individually by inserting them into different slots.

### **Solutions**

- Reseat the RAM modules, ensuring they are firmly and correctly inserted into the slots.
- Replace faulty RAM modules with new, compatible ones.
- Clean the RAM slots and modules' connectors with a soft brush or compressed air.

#### **3.1.1.4 Storage Device Failures**

##### **Symptoms**

- The computer takes a long time to boot, there are frequent read/write errors, the system fails to recognize the drive, or there are unusual noises from the drive.

##### **Diagnosis**

- Use disk check utilities like CHKDSK (Windows) or Disk Utility (MacOS) to scan for errors.
- Check the drive's SMART status using tools like CrystalDiskInfo or manufacturer-specific utilities.
- Listen for unusual sounds such as clicking or grinding, which indicate mechanical failure in HDDs.

##### **Solutions**

- Back up important data immediately if the drive shows signs of failure.
- Run disk repair tools to fix logical errors.
- Replace the failing drive with a new one and restore data from backups.
- For SSDs, ensure firmware is up-to-date and avoid excessive write operations.

#### **3.1.1.5 Peripheral Issues**

##### **Symptoms**

- Keyboards, mice, printers, or other peripherals are non-responsive or malfunctioning.

##### **Diagnosis**

- Check that the peripheral is properly connected to the computer.
- Test the peripherals on another computer to rule out device-specific issues.
- Verify that the correct drivers are installed and up to date.
- Inspect cables and connectors for physical damage.

## **Solutions**

- Reseat or replace cables and connectors.
- Update or reinstall drivers from the manufacturer's website.
- Replace the faulty peripheral if it does not work on multiple systems.
- Check the system's USB ports or peripheral connection ports for damage or dirt.

### **3.1.1.6 Graphics Card Issues**

## **Symptoms**

- No display output, distorted visuals, screen artefacts, or system crashes during graphics-intensive tasks.

## **Diagnosis**

- Ensure the graphics card is firmly seated in the PCIe slot.
- Check for driver updates or roll back recent driver updates.
- Test the graphics card on another system if possible.

## **Solutions**

- Reseat the graphics card and ensure any auxiliary power connectors are connected.
- Update or reinstall the graphics card drivers.
- Replace the graphics card if it is determined to be faulty.

### **3.1.2 Common Software Issues and Solutions**

Understanding and addressing common software issues is crucial for maintaining the smooth operation of a computer system. Software problems can arise from a variety of sources, including operating system errors, application crashes, driver issues, and

malware infections. Below is a detailed explanation of these common software issues and their solutions.

### **3.1.2.1 Operating System Problems**

Operating system (OS) issues can significantly impact a computer's functionality, as the OS manages all hardware and software resources.

#### **Symptoms**

- Slow performance, frequent crashes, error messages, failed updates, and system not booting.

#### **Diagnosis**

- **Event Viewer (Windows):** Check for error logs and warnings that provide information about the problem.
- **Activity Monitor (Mac):** Monitor system processes and resource usage to identify problematic applications or processes.
- **Safe Mode:** Boot into Safe Mode to see if the problem persists, which can help determine if the issue is related to third-party software or drivers.
- **System Logs:** Review system logs for error messages and warnings.

#### **Solutions**

- **Update OS:** Ensure the operating system is up to date with the latest patches and updates.
- **System Restore:** Use system restore points to revert the system to a previous state where it was functioning correctly.
- **Repair Utilities:** Run built-in repair tools like SFC (System File Checker) and DISM (Deployment Imaging Service and Management Tool) on Windows, or Disk Utility on macOS.
- **Reinstallation:** If issues persist, consider performing a clean installation of the operating system.

### **3.1.2.2 Application Errors**

Applications can malfunction for various reasons, including compatibility issues, corrupted files, and resource conflicts.

## Symptoms

- Crashing applications, freezing, error messages on launch, and unexpected behaviour.

## Diagnosis

- **Error Messages:** Note any error messages that appear when the application crashes.
- **Event Viewer (Windows):** Check application-specific logs for error messages.
- **Console (Mac):** Review logs for application-specific errors.
- **Compatibility Mode:** Run the application in compatibility mode to see if the issue is related to OS compatibility.

## Solutions

- **Update or Reinstall Application:** Ensure the application is updated to the latest version. If the problem persists, uninstall and reinstall the application.
- **Check Compatibility:** Verify that the application is compatible with the operating system version.
- **Repair Installation:** Some applications offer a repair option in their installer, which can fix corrupted files.
- **Resource Conflicts:** Check for conflicts with other applications or services, adjust settings, or disable conflicting software.

### 3.1.2.3 Driver Issues

Device drivers are essential for hardware to communicate with the operating system. Faulty or outdated drivers can cause a range of issues.

## Symptoms

Hardware malfunctions, system crashes, blue screen errors (BSOD), and devices not recognized by the system.

## Diagnosis

- **Device Manager (Windows):** Look for devices with a yellow exclamation mark or red cross, indicating driver issues.
- **System Information (Mac):** Check the status of connected devices and their drivers.

**Event Viewer (Windows):** Review system logs for driver-related errors.

## Solutions

- **Update Drivers:** Download and install the latest drivers from the manufacturer's website.
- **Roll Back Drivers:** If a recent driver update caused the issue, roll back to the previous version.
- **Reinstall Drivers:** Uninstall the problematic driver and reinstall it.
- **Compatibility Checks:** Ensure the drivers are compatible with the current operating system version.

### 3.1.2.4 Malware Infections

Malware can cause significant disruptions to a computer system, including data loss, performance degradation, and unauthorised access.

## Symptoms

- Slow performance, unexpected behaviour, pop-up ads, redirected web pages, and unauthorised changes to system settings.

## Diagnosis

- **Antivirus Scan:** Run a full system scan with updated antivirus software.
- **Anti-Malware Tools:** Use specialised tools like Malwarebytes to detect and remove malware.
- **Check Running Processes:** Look for unusual or unfamiliar processes in Task Manager (Windows) or Activity Monitor (Mac).
- **Safe Mode:** Boot into Safe Mode and run scans, as some malware can hide during normal operation.

## Solutions

- **Remove Malware:** Use antivirus and anti-malware tools to remove infections.
- **Update Security Software:** Ensure all security software is up to date.
- **Restore System:** If malware has caused significant damage, use system restore points to revert to a clean state.
- **Reinstall OS:** In severe cases, a clean reinstallation of the operating system may be necessary to ensure all malware is removed.

## 3.2 Diagnostic Tools

Diagnostic tools are software programs or hardware devices that help identify and diagnose issues or problems with a computer system. These tools help diagnose problems with hardware, software, and network components, providing critical information for troubleshooting and repair. Below is a detailed explanation of various diagnostic tools and how to use them effectively.

### 3.2.1 BIOS/UEFI Diagnostics

#### Functions

BIOS (Basic Input/Output System) and UEFI (Unified Extensible Firmware Interface) are firmware interfaces that initialise hardware during the boot process and provide runtime services for the operating system.

#### Usage

- **Accessing BIOS/UEFI:** To enter BIOS/UEFI, restart the computer and press the designated key (usually Del, F2, Esc, or F10) during startup.
- **Checking System Information:** View detailed information about hardware components such as the CPU, RAM, storage devices, and system temperatures.
- **Running Diagnostics:** Some BIOS/UEFI interfaces include built-in diagnostic tools to test hardware components like memory and hard drives.
- **Adjusting Settings:** Change settings for boot order, enabling or disabling hardware components, and configuring power management options.

### 3.2.1 Built-in Diagnostic Tools

Built-in diagnostic tools are software programs or utilities that come pre-installed with an operating system or hardware device to help users diagnose and troubleshoot issues with their systems.

### **3.2.1.1 Windows Tools**

1. **Event Viewer:** Provides detailed logs of system events, including errors, warnings, and informational messages.

**Usage:** Open Event Viewer (Windows + X, then select Event Viewer), navigate to Windows Logs, and check the System and Application logs for errors.

2. **Task Manager:** monitors system performance, running processes, and resource usage.

**Usage:** Open Task Manager (Ctrl + Shift + Esc), check the Performance tab for CPU, memory, disk, and network usage, and identify resource-hogging processes.

3. **Resource Monitor:** Offers detailed information about resource usage and helps identify performance bottlenecks.

**Usage:** Open Resource Monitor from Task Manager or by typing "resmon" in the Start menu, and monitor CPU, memory, disk, and network activity.

4. **Windows Memory Diagnostic:** Tests the computer's memory for errors.

**Usage:** Type "Windows Memory Diagnostic" in the Start menu, select "Restart now and check for problems," and follow the on-screen instructions.

### **3.2.1.2 Mac Tools**

1. **Activity Monitor:** Provides an overview of system performance and resource usage.

**Usage:** Open Activity Monitor (Applications > Utilities > Activity Monitor) and check the CPU, Memory, Disk, and Network tabs for detailed information.



2. **Disk Utility:** Checks and repairs disk permissions and verifies disk integrity.

**Usage:** Open Disk Utility (Applications > Utilities > Disk Utility), select a disk, and click “First Aid” to check and repair the disk.

3. **Console:** Displays system logs and diagnostic messages.

**Usage:** Open Console (Applications > Utilities > Console) and review logs for error messages and system diagnostics.

### 3.2.3 Third-Party Utilities

Third-party utilities are software applications developed by companies or individuals that offer additional diagnostic, maintenance, optimization, and troubleshooting capabilities beyond what is provided by built-in tools or utilities. Some third-party utilities include:

1. **MemTest86:** is a standalone memory testing tool that runs from a USB drive.

**Usage:** Download MemTest86, create a bootable USB drive, boot from the USB drive, and let the tool run multiple passes to test the memory.

2. **CrystalDiskInfo:** is a tool for monitoring the health of hard drives and SSDs using SMART data.

**Usage:** Install CrystalDiskInfo, open the application, and check the health status, temperature, and other SMART attributes of the storage devices.

3. **HWMonitor:** Monitors system hardware, including temperatures, voltages, and fan speeds.

**Usage:** Install HWMonitor, open the application, and review the real-time monitoring data for various hardware components.

### 3.2.4 Network Troubleshooting Tools

Network troubleshooting tools are software utilities and protocols designed to diagnose and resolve issues within computer networks. They assist in identifying network problems, optimising performance, and ensuring reliable connectivity. Some network troubleshooting tools include:

1. **Ping:** The most basic and widely used network troubleshooting tool, ping measures the round-trip time for messages sent from a source computer to a destination computer. A successful ping indicates connectivity between the two devices, while failed pings suggest potential connectivity issues.
2. **Traceroute/Tracert:** This tool helps trace the path taken by data packets across a network to reach a specific destination. It reveals the intermediate devices (hops) between the source and destination, along with the time it takes for packets to travel each hop. Traceroute is useful for identifying bottlenecks or outages along the network path.
3. **Ipconfig/Ifconfig:** These commands (ipconfig for Windows and ifconfig for Linux/macOS) provide information about a device's network configuration, including its IP address, subnet mask, default gateway, and DNS servers. This information is crucial for troubleshooting connectivity and configuration issues.
4. **Nslookup:** This command-line tool allows querying Domain Name System (DNS) servers to obtain domain name or IP address mapping information. It's helpful for verifying DNS resolution and diagnosing DNS-related connectivity problems.
5. **Netstat:** This command displays information about network connections on a device, including active TCP connections, listening ports, and routing tables. Network administrators use Netstat to identify suspicious connections, troubleshoot routing problems, and monitor network activity.

### 3.3 Repair Techniques and Best Practices

Repairing computer systems involves a combination of technical skills, systematic approaches, and best practices to ensure effective and safe resolution of hardware and software issues. Below is an in-depth exploration of various repair techniques and best practices to follow.

#### 3.3.1 General Best Practices for Computer Repair

When repairing computers, adhering to general best practices ensures safety, efficiency, and the prevention of further damage to the system. Here are some comprehensive guidelines to follow:

##### 3.3.1.1 Safety First

1. **Electrostatic Discharge (ESD) Protection:** Use an anti-static wrist strap or mat to prevent electrostatic discharge (ESD) that can damage sensitive components.
2. **Power Off:** Always turn off and unplug the computer before opening the case or working on internal components.
3. **Proper Tools:** Use the appropriate tools (e.g., screwdrivers, pliers) and handle components gently to avoid damage.

### 3.3.1.2 Documentation and Preparation

1. **Backup Data:** Before performing any major repairs, back up important data to avoid data loss.
2. **Take Notes:** Document the steps taken and the configurations/settings before making changes, which helps in troubleshooting and restoring the system.
3. **Use Manufacturer Resources:** Refer to the manufacturer's manuals and websites for specific repair guides and support.

### 3.3.2 Hardware Repair Techniques

#### 3.3.2.1 Power Supply Replacement

**Diagnosis:** If the computer does not power on or powers off unexpectedly, test the power supply with a power supply tester or multimeter.

**Replacement:** Disconnect all power connectors, remove the old power supply, install the new one, and reconnect all necessary cables.

#### 3.3.2.2 Memory (RAM) Replacement

**Diagnosis:** Run memory diagnostic tools (e.g., Windows Memory Diagnostic, MemTest86) if you suspect faulty RAM.

**Replacement:** Open the case, release the clips holding the RAM module, carefully remove it, and insert the new RAM, ensuring it is properly seated and the clips are secured.

#### 3.3.2.3 Storage Device Replacement

**Diagnosis:** Use SMART data (e.g., CrystalDiskInfo) and disk-checking tools to identify failing hard drives or SSDs.

**Replacement:** Disconnect the drive's data and power cables, remove the old drive, install the new drive, reconnect the cables, and initialize the drive in the operating system.

#### **3.3.2.4 Graphics Card Replacement**

**Diagnosis:** If experiencing display issues or poor graphics performance, test the graphics card in another system if possible.

**Replacement:** Remove the screws and power connectors, release the card from the PCIe slot, install the new card, and secure it with screws and connectors.

#### **3.3.2.5 CPU Replacement**

**Diagnosis:** If the system is slow or unresponsive, ensure the CPU is not overheating and check for thermal paste degradation.

**Replacement:** Remove the CPU cooler, clean off the old thermal paste, release the CPU from its socket, install the new CPU, apply new thermal paste, and reattach the cooler.

### **3.3.3 Software Repair Techniques**

#### **3.3.3.1 Operating System Repair:**

1. **System Restore:** Use system restore points to revert the OS to a previous, stable state.
2. **Startup Repair:** Run built-in startup repair tools (e.g., Windows Startup Repair) to fix boot issues.
3. **Reinstallation:** If the OS is severely corrupted, perform a clean installation while ensuring data is backed up.

#### **3.3.3.2 Application Repair**

1. **Update or Reinstall:** Update the application to the latest version, or uninstall and reinstall it to fix corrupted files.

2. **Compatibility Settings:** Adjust compatibility settings to resolve issues with older applications on newer OS versions.

### 3.3.3.3 Driver Repair

1. **Update Drivers:** Use Device Manager (Windows) or System Information (Mac) to update outdated or corrupt drivers.
2. **Roll Back Drivers:** If a new driver causes issues, roll back to the previous version.

**Reinstall Drivers:** Uninstall the problematic driver and reinstall it from the manufacturer's website.

### 3.3.4 Network Repair Techniques

#### 3.3.4.1 Connectivity Issues

1. **Check Cables and Connections:** Ensure all network cables are properly connected and functional.
2. **Reset Network Devices:** Restart the router, modem, and network switches to resolve temporary issues.
3. **IP Configuration:** Verify the computer's IP settings (e.g., IP address, subnet mask, gateway) and ensure they are correct.

#### 3.3.3.2 Wireless Network Issues

1. **Signal Strength:** Check for interference from other devices and ensure the computer is within range of the wireless signal.
2. **Network Settings:** Reset network settings or reconfigure the wireless network profile on the computer.

### 3.3.4 Data Recovery Techniques

#### 3.3.4.1 Logical Recovery

1. **File Recovery Software:** Use data recovery tools (e.g., Recuva, EaseUS Data Recovery) to retrieve deleted or lost files.
2. **System Restore:** Use system restore points to restore the system to a previous state.

### **3.3.4.2 Physical Recovery**

1. **Professional Services:** For physically damaged drives, seek professional data recovery services.
2. **Drive Cloning:** Clone the failing drive to a new drive to attempt data recovery from the clone.

## **4.0 Conclusion**

## **5.0 Summary**

In this unit, you learned about the importance of troubleshooting and repair in maintaining computer systems. We covered common hardware and software issues, diagnostic tools and techniques, and best practices for safe and effective repairs. Practical exercises provided hands-on experience with real-world troubleshooting scenarios, equipping you with the skills to diagnose and resolve various computer problems.

## **6.0 Tutor-Marked Assignment (TMA)**

### **Question 1: Troubleshooting Approach**

Describe a systematic approach to troubleshooting a computer that fails to power on. Include steps for diagnosing potential hardware issues.

### **Question 2: Diagnosing Overheating Issues**

Explain the symptoms and diagnosis process for a computer experiencing overheating. What are some common solutions to resolve this issue?

### **Question 3: Software Errors**

Discuss the steps you would take to troubleshoot and resolve an application that frequently crashes on launch. Include potential causes and solutions.

