Computer Service Technician - CST

Competency Requirements

This Computer Service Technician - CST Competency listing serves to identify the major knowledge, skills, and training areas which the Computer Service Technician needs in order to perform the job of servicing the hardware and the systems software for personal computers (PCs). The present CST COMPETENCIES only address operating systems for Windows current version, plus three older. Included also are general common Linux and Apple competency information, as proprietary service contracts still keep most details specific to in-house service. The CST Competency is written so that it can be used as a course syllabus, or the study directed towards the education of individuals, who are expected to have basic computer hardware electronics knowledge and skills.

Computer Service Technicians (CSTs) must be knowledgeable in the following technical areas:

1.0 Safety Procedures / Handling / Environmental Awareness

1.1 Explain the need for physical safety:
   1.1.1 Lifting hardware
   1.1.2 Electrical shock hazard
   1.1.3 Fire hazard
      1.1.3.1 Differentiate the classes of fires (A, B, C, D & K) and the types of extinguishers used to fight them
   1.1.4 Chemical hazard
      1.1.4.1 Explain the purpose for Material Safety Data Sheets (MSDS)
   1.1.5 Tool use hazard(s)

1.2 Summarize work area safety and efficiency

1.3 Describe potential hazards in both in-shop and in-home environments
   1.3.1 Describe personal protection equipment (PPE) needs, i.e. NFPA Table 130.5(c)
   1.3.2 Describe other Occupational Safety Health Admin.(OSHA) electronic and electrical safety rules

1.4 Define First Aid procedures
   1.4.1 Explain the First Aid concepts and its particular importance to workers in electric and electronics fields explaining precautions for the untrained

1.5 Describe solder safety as it pertains to individuals or damage to components, products or workspace

1.6 Describe proper electronic and electrical recycling and disposal procedures

2.0 Computer Assembly and Disassembly

2.1 List tools required for removal and installation of all computer system components
   2.1.1 Explain which tools/testing equipment are used for procedures

2.2 Describe the proper removal and installation of a central processing unit (CPU)
   2.2.1 Describe proper use of Electrostatic Discharge (ESD) equipment and procedures:
      2.2.1.1 bench pads
      2.2.1.2 ESD mat
      2.2.1.3 anti-static wrist strap
      2.2.1.4 constant monitoring station
      2.2.1.5 precautions when handling components
      2.2.1.6 why components must be stored in anti-static packaging
   2.2.2 List the harmful effects of electromagnetic interference (EMI)
   2.2.3 Describe removal and installation procedures for CPU heatsink/fan
   2.2.4 Explain the importance of heatsink grease/thermal material

2.3 Describe proper removal and correct installation procedures for Random-Access Memory (RAM)
   2.3.1 Proper banking positions
   2.3.2 Correct RAM utilized with proper banking keyway procedures
   2.3.3 Proper force/pressure used to install/seat RAM

2.4 Describe the proper removal and installation of a graphics processing unit (GPU)

2.5 Explain the precautions, tools and routines involved in the removal and installation of the following:
2.5.1 Power Supplies
2.5.2 Expansion cards
2.5.3 Motherboard jumpers
2.5.4 Cables and wiring harnesses
2.5.5 Secondary storage devices
2.5.6 Heat dissipation devices

2.6 Explain the proper removal and installation procedures for a motherboard and/or daughterboard

3.0 Motherboards / Mainboard and Buses / System Resources

3.1 Describe and compare the differences between common mainboard design characteristics:
   3.1.1 ATX
   3.1.2 ITX
   3.1.3 SSI CEB
   3.1.4 X99, X99A
   3.1.5 Z170
   3.1.6 Micro-ATX and FlexATX
   3.1.7 Mini-ATX
   3.1.8 LPX and NLX
   3.1.9 Mini-ITX, Nano ITX and Pico ITX
   3.1.10 Mobile ITX and Neo-ITX
   3.1.11 ISX

3.2 Compare chipset architecture, features and differences of:
   3.2.1 Northbridge / Southbridge
   3.2.2 Sandy bridge
   3.2.3 Ivy bridge
   3.2.4 Haswell
   3.2.5 Broadwell

3.3 Define the Control, Data, and Address Buses

3.4 Explain Bus function and compare addressing differences
   3.4.1 Front side bus replaced by DMI, QuickPath Interconnect and Hyper Transport
   3.4.2 Back side bus
   3.4.3 Memory bus
   3.4.4 I/O buses
   3.4.5 Universal serial bus (USB)

3.5 Differentiate and describe other expansion slots:
   3.5.1 Peripheral Component Interconnect (PCI)
   3.5.2 PCI Express (PCIe), and Extended PCI (PCI-X)
   3.5.3 Accelerated Graphics Port (AGP)
   3.5.4 ExpressCard in place of Laptop PC card (PCMCIA)
   3.5.5 Industry Standard Architecture (ISA) slots (not found on modern motherboards):
      3.5.5.1 Audio/Modem Riser (AMR)
      3.5.5.2 Communication and Network Riser (CNR) {Modem/Network Card}

3.6 Describe the Interrupt Request (IRQ) signal from a device to the CPU

3.7 Explain the difference between using a Programmable Interrupt Controller (PIC), Advanced PIC (APIC) and Plug and Play (PNP) devices
   3.7.1 Describe Advanced Programmable Interrupt Controller (APIC) and x2APIC
   3.7.2 Describe how a PNP manager works

3.8 List common selections for ports architecture
   3.8.1 Describe the architecture and use of I/O interfaces and addresses

3.9 Explain the purpose and use of Direct Memory Access (DMA)
   3.9.1 32bit and 64bit
   3.9.2 Programmed Input/Output (PIO)
   3.9.3 Scratchpad RAM
   3.9.4 Cache coherency

3.10 Explain Device Drivers and how they work within the computer system

3.11 Identify additional memory module sockets
   3.11.1 Dual In-line Memory Module (DIMM)
   3.11.2 Double Data Rate Synchronous Dynamic Random-Access Memory (DDR SDRAM)
   3.11.3 Small Outline DIMM (SODIMM)
3.12 Describe Extensible Firmware Interface (EFI) and Unified EFI (UEFI) features
3.13 Describe Basic Input Output System (BIOS) firmware functions including:
   3.13.1 why beep codes are used {see Comp. 12.8}
   3.13.2 how to set/clear passwords
   3.13.3 procedures to upgrade/update/flash the BIOS
   3.13.4 changing the boot order in the BIOS
3.14 Explain the configuration storage of Complementary Metal-Oxide-Semiconductor (CMOS),
   known as CMOS RAM or BIOS RAM
   3.14.1 Describe MAC's Non-Volatile RAM (NVRAM) [or Parameter RAM (PRAM)]
3.15 Explain the differences between riser card and daughterboard
3.16 Explain the use of dipswitch configurations and settings
3.17 Explain the purpose of mainboard (motherboard) jumpers

4.0 Processor Characteristics
4.1 Explain the purpose and characteristics of CPUs used in specific sockets and slots
   4.1.1 AMD®
   4.1.2 Intel®
4.2 Compare and contrast the differences between all multicore CPU architectures
4.3 State the Word Size (Internal Data Bus) and External Data Path bit widths for various CPUs
4.4 Explain the differences between the L1, L2 and L3 cache
   4.4.1 Describe Advanced Transfer Cache bus width and its benefits
4.5 Explain the purpose and characteristics of GPUs
   4.5.1 Differentiate between a CPU and GPU
   4.5.2 Explain why GPUs integrated with CPUs can be better than CPUs alone
4.6 Differentiate between simultaneous multithreading and hyperthreading
4.7 Explain the factors that determine CPU/GPU speed
4.8 Describe the advantages and disadvantages for CPU/GPU underclocking and overclocking
4.9 Explain why it is important to have CPU/GPU cooling
4.10 Explain the advantages and disadvantages for different methods of processor cooling:
   4.10.1 Heatsinks
   4.10.2 Thermal grease/compound
   4.10.3 Fans
   4.10.4 Liquid cooling
      4.10.4.1 Nitrogen
      4.10.4.2 Water
      4.10.4.3 Oil (mineral)

5.0 Memory Characteristics
5.1 Differentiate flash memory specifications: NAND versus NOR
5.2 Differentiate RAM specifications: DIMM, Rambus In-line Memory Module (RIMM) and SODIMM
5.3 Describe memory characteristics and installation procedures of:
   5.3.1 Static RAM (SRAM)
   5.3.2 Dynamic RAM (DRAM)
   5.3.3 Synchronous Dynamic RAM (SDRAM)
   5.3.4 Double Data Rate (DDR) memory {RAM generations}
   5.3.5 RAMBUS
5.4 Compare RAM bit widths and speed over the generations from SDRAM through DDR5
5.5 Identify generational differences between LPDDRs, DDRs and Graphics DDRs
5.6 Explain Error Correction Code (ECC) memory versus Parity and Non-parity (logic parity/fake) RAM
   5.6.1 Error Detection and Correction (EDAC) or error control
5.7 Explain memory requirements for different operating systems, including minimum and maximum memory requirements

6.0 Secondary Storage Devices
6.1 Identify and differentiate among Hard Disk Drives (HDD)
   6.1.1 Serial Advanced Technology Attachment (Serial ATA)
      6.1.1.1 Mini SATA (mSATA)
   6.1.2 Legacy Parallel ATA
   6.1.3 Differentiate between Serial ATA (eSATA) and old Parallel ATA connections
6.2 Explain the operational characteristics of a Solid-State Drive (SSD)
   6.2.1 Explain the differences between the more popular SSDs:
      6.2.1.1 mSATA SSD connecting interface
      6.2.1.2 M.2 SSD interface (especially for mobility)
      6.2.1.3 Full size SATA SSD interface
      6.2.1.4 Non-Volatile Memory Express (NVMe) storage interface
      6.2.1.5 Serial Attached SCSI (SAS) SSD connecting interface
      6.2.1.6 PCIe SSD connecting interface
   6.2.2 Describe hybrid drive technology such as Solid-State Hybrid Drive (SSHD) or Dual-Drive systems (Linux “bcache” and “dm-cache” along with Apple’s Fusion Drive)
   6.2.3 Identify the differences between NVMe, Advanced Host Controller Interface (AHCI) and Extended Integrated Drive Electronics (EIDE) transfer protocols

6.3 Describe the differences between Enterprise Flash Drives (EFDs) and SSDs
6.4 Explain how data is stored on a hard drive
6.5 Compare and contrast the different Serial ATA specifications
6.6 Describe PIO modes used in ATA interfacing
6.7 Describe EIDE cable differences for PIO mode/ATA33 and ATA66/ATA100 and ATA133
6.8 Compare the various modes and transfer rates of Ultra Direct Memory Access (UDMA)
6.9 Describe small-computer-system-interface (SCSI) hard drive technology and how it differs from the EIDE interface
6.10 Describe the storage differences between New Technology File System (NTFS) and File Allocation Table (FAT)
6.11 List and explain the applications for removable storage:
      6.11.1 Jump drive, flash drive, thumb drive, and secure digital (SD) cards
      6.11.2 External DVD-RW, CD-RW hard and solid-state drives
      6.11.3 Tape drives (magnetic)
6.12 Describe the CD-ROM/CD+/-RW technology and state its advantages and uses
6.13 Compare DVD, DVD-RAM and DVD+/–RW technologies
6.14 Identify how Cloud storage works
      6.14.1 Explain how Desktop as a Service (DaaS) works
6.15 Explain/Describe Blu-ray™ technology

7.0 Adapter Cards and Peripheral Devices
7.1 Explain how to install and use biometric devices:
      7.1.1 Thumbprint scanner/reader
      7.1.2 Facial recognition scanner
      7.1.3 Retinal scanner
      7.1.4 Signature analyzer
7.2 Explain the standards for Network Interface Card (NIC)
7.3 Explain how to install an NIC and a wireless NIC
7.4 Explain how to install and use soundcards
7.5 Explain how to install and use various types of video graphics cards:
      7.5.1 PCIe
      7.5.2 PCI
      7.5.3 AGP
7.6 Describe the principles and characteristics of a TV tuner
7.7 Compare the different printer technologies used with PCs/Laptops
7.8 Describe scanner technology, installation and operation
7.9 Explain TWAIN™ image acquisition compliance for scanners and digital cameras
7.10 Explain how to install/interface multimedia devices:
      7.10.1 Musical Instrument Digital Interface (MIDI)
      7.10.2 Digital cameras
      7.10.3 Web cameras
      7.10.4 Portable Digital Media Interface (PDMI)
7.11 Explain keyboard theory and standards
7.12 Explain mouse theory and standards
7.13 Compare additional peripheral technologies
      7.13.1 Legacy PS/2 (6-pin mini-DIN connector)
7.13.2 Universal Serial Bus (USB) (generational)
7.13.3 Wireless (i.e. IEEE 802.11ax and prior)
7.14 Describe a monitor’s basic features and differences between a CRT, LCD, LED, 4K/8K and Plasma
  7.14.1 Explain the differences between SVGA, DVI, HDMI and DisplayPort
  7.14.2 Explain Scalable Link Interface (SLI) when used with dual video boards

8.0 Input/Output (I/O) Ports

8.1 Explain the differences and functions for various port architectures:
  8.1.1 Serial and Parallel
  8.1.2 USB 1.x, 2.0, 3.0, 3.1, 3.2 and 4
  8.1.3 IEEE 1394/FireWire®
  8.1.4 Network Interface Card (NIC)
  8.1.5 Display - HDMI, DVI, VGA, S-Video, RCA™ and DisplayPort
  8.1.6 Local Area Network (LAN)
  8.1.7 PS/2
  8.1.8 Audio - MIDI
  8.1.9 PDMI
  8.1.10 COMs and LPTs
  8.1.11 Thunderbolt™ (Apple)
  8.2 Differentiate between wireless, USB and legacy RS232c standards for ports
  8.3 Explain the generational specifications of parallel ports SPP, EPP and ECP
  8.4 Compare USB 1.x, 2.0, 3.0, 3.1,3.2 and 4 port transfer rates and intended uses
  8.5 Identify the transfer rates and intended uses for IEEE 1394 FireWire® (iLink) operation
  8.6 Explain how infrared communications take place in PCs/Laptops
  8.6.1 Define the Infrared Data Association® (IrDA®) standard protocol
  8.7 Describe Game/MIDI ports
  8.8 Explain how to identify various legacy ports by their connectors on a PC

9.0 Power Concepts and Power Supplies

9.1 Describe and identify AT, ATX, ATX12V power supplies
  9.1.1 List the major differences between AT, ATX and ATX12V
  9.2 Compare the usage and capabilities of AT, ATX, and ATX12V power supplies
  9.3 Describe TFX12V configuration for small form factor computers
  9.4 Compare ATX versus BTX power supply family
  9.5 Explain the purpose of an uninterruptible power supply (UPS)
  9.6 Describe switch-mode power supplies (SMPS)
  9.6.1 Capacitive switching

10.0 Basic Networking Concepts Applicable to Computer Service

10.1 Topologies
  10.1.1 Identify and describe the different characteristics of each LAN topology:
    10.1.1.1 Point-to-Point
    10.1.1.2 Bus
    10.1.1.3 Ring
    10.1.1.4 Star
    10.1.1.5 Hybrid
    10.1.1.6 Mesh
  10.1.2 Differentiate between a physical and logical topology
  10.1.3 Explain the need for network connectivity devices:
    10.1.3.1 Network interface adapter
    10.1.3.2 Hub/Repeater
    10.1.3.3 Switch
    10.1.3.4 Router
  10.1.4 Explain media access control (MAC) addressing
  10.1.5 Explain the use of a network bridge
  10.1.6 Explain router and other components in the network layer 3 of the OSI model

10.2 Cabling
  10.2.1 Briefly describe noise immunity, bandwidth, latency and attenuation
10.2.2 Differentiate between the basic transmission modes:
  10.2.2.1 Simplex
  10.2.2.2 Half Duplex
  10.2.2.3 Full Duplex

10.2.3 Describe different media use to transmit data:
  10.2.3.1 Unshielded twisted pair (UTP) cabling
  10.2.3.2 Shielded twisted pair (STP) cabling
  10.2.3.3 Fiber-optic cabling
  10.2.3.4 Infrared light
  10.2.3.5 Wireless RF; Wi-Fi™

10.2.4 List the different applications and bandwidth for CAT5e, CAT6/6A, and CAT8
  10.2.4.1 Describe CAT7/7a issues

10.2.5 Describe the pin-out difference between TIA-568A and TIA-568B standards

10.2.6 Explain when to use an 8P8C (RJ45) and 6P4C (RJ14) connector

10.2.7 Describe the design difference between a crossover cable and a straight through cable

10.2.8 Define 10/100/1000BaseT (Twisted pair) and its use

10.2.9 Describe 10/100/400 GbE Gigabit Ethernet

10.2.10 Compare the differences and advantages between fiber-optic cable and twisted pair

10.2.11 Describe methods of troubleshooting cabling systems

10.3 Protocols
  10.3.1 Define and identify network protocol(s)

10.3.2 Differentiate between each network environment and the protocol used
  10.3.2.1 Apple Filing Protocol (AFP)
  10.3.2.2 IPX/SPX
  10.3.2.3 TCP/IP

10.3.3 Explain why TCP/IP Protocol is widely used and the configuration process

10.3.4 Explain the basic differences between IPv4 and IPv6

10.4 Architectures
  10.4.1 Explain the Open Systems Interconnection model (OSI model)
    10.4.1.1 Describe the OSI layers and applications

10.4.2 Differentiate between older LAN Ethernet (IEEE 802.3), Carrier Sense Multiple Access/Collision Detection (CSMA/CD) versus Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) in Wireless LAN (WLAN (IEEE 802.11) versus CSMA/CR used in controller area networks (CAN)
    10.4.2.1 Explain token passing

10.4.3 List the throughput, range and frequencies associated with IEEE 802.11x:
    10.4.3.1 IEEE 802.11a
    10.4.3.2 IEEE 802.11b/g/n
    10.4.3.3 IEEE 802.11ac
    10.4.3.4 IEEE 802.11ax

10.4.4 Describe the differences between Bluetooth® (IEEE 802.15.4) and IEEE 802.11x Cellular RF specifications

10.4.5 Compare the differences between Broadband, Digital Line Subscriber (DSL) and satellite technologies

10.4.6 Explain the basics of Network Operating Systems (NOS)

10.4.7 Explain how Directory/File/Drive Sharing is accomplished

10.5 Network Security:
  10.5.1 Describe the principles of data integrity and protection

10.5.2 Describe the principles of network security for wired and wireless networks
    10.5.2.1 Remote Authentication Dial-In User Service (RADIUS)
    10.5.2.2 Extensible Authentication Protocol (EAP) and IEEE 802.1x
    10.5.2.3 Wi-Fi™ Alliance’s Wi-Fi Protected Access 3 (WPA3), WPA2 (2004), WPA, or Wired Equivalent Privacy (WEP) (in 802.11b in 1997)

10.5.3 Explain the need for and purpose of a network firewall

10.5.4 Explain the purpose for wireless encryption keys
    10.5.4.1 Temporal Key Integrity Protocol (TKIP)
    10.5.4.2 Advanced Encryption Standard (AES)
    10.5.4.3 Counter Mode with Cipher Block Chaining Message Authentication Code Protocol (CCMP) (IEEE 802.11i)
11.0 Portables
11.1 Explain the differences between a Laptop and various Tablet architectures
11.2 Explain how to remove and install SODIMMs onto portable devices
11.3 Describe the purpose of a docking station
11.4 Explain the technology of an LCD versus LED display
11.5 Describe the various I/O ports available and their uses
11.6 Describe precautions and usage of batteries in laptop PCs
11.7 Explain common power management techniques
11.8 Explain the purpose for a touchpad, pointing stick and track point

12.0 Troubleshooting / Preventive Maintenance / Security Measures
12.1 Describe purpose and the characteristics of a clean workspace/area
12.2 Explain the importance of visual inspections
12.3 Differentiate between hardware and software troubleshooting
12.4 Describe the use of diagnostic software used to diagnose and isolate PC problems
12.5 List utility software that technicians should be familiar with (Scandisk, Defragmentation, OEM specific utilities, etc.)
12.6 List environmental problems common to PCs (temperature, dust and dirt, smoke, etc.)
12.7 Identify hardware-based PC security and diagnostics
  12.7.1 Explain the Trusted Platform Module (TPM) technology
  12.7.2 Explain the use of POST diagnostic cards for troubleshooting
  12.7.3 Explain the use of FRU-level troubleshooting techniques
12.8 Explain the differences between manufacturers' BIOS Beep Codes
12.9 Use of basic troubleshooting commands and utilities (such as Fdisk, Format, Sys, Xcopy, etc.) as used in the current + two older versions of Windows OS
  12.9.1 Describe inter-relations between commands on different file systems (i.e., IPCONFIG, IFCONFIG, WINIPCFG vs. DIR – Basic navigation)
12.10 Describe the Microsoft Management Console (MMC) snap-in utility and its application for managing system administrative tools
  12.10.1 Identify how to install and create, save and use the MMC snap-in tools
  12.10.2 Explain how to unify and simplify system management tasks through the Microsoft Management Console (MMC)
12.11 List applicable tools for PC maintenance and repair
  12.11.1 PC vacuums
  12.11.2 Compressed air
  12.11.3 Tool kit
  12.11.4 ESD protective devices
  12.11.5 Lint free cloth
12.12 Explain how to properly document and record a computer repair
12.13 Explain the importance of making timely backups in regards to preventative maintenance
12.14 List preventive maintenance procedures relating to static safety causes and effects; ESD
12.15 Describe the usage of software migration tools such as: PCAnywhere and Laplink PCmover, USMT - User State Migration Tool, USMTGUI, Windows Easy transfer, IObit, PCtransfer, etc.
12.16 Describe the deployment and application of both software and physical firewalls
  12.16.1 Port Security
  12.16.2 Exceptions
  12.16.3 Filters
12.17 Explain how performance Utilities/Diagnostics software are used
12.18 Describe the usage of Adware, Malware Spyware, Rootkits, Trojans and Worms along with the prevention keeping them away from your computer
12.19 Describe the function of Antivirus software
12.20 Describe how to access and use Safe Mode

13.0 Operating Systems (Windows™ 7, 8, 10, 11 / Linux / Apple mac™)
13.1 Explain how to load different operating systems:
  13.1.1 Windows 10/11
  13.1.2 Windows 8
13.1.3 Windows 7
13.1.4 Linux (openSUSE, Mandriva, Ubuntu, Redhat and Fedora)
13.1.5 Apple macOS™

13.2 Describe the basic functions of an operating system
  13.2.1 Identify the purpose of Panther™ Log Files

13.3 Explain multiuser, multitasking and multiprocessor operations

13.4 Describe the events that occur during boot-up for Linux and Windows operating systems

13.5 Describe general differences between Windows 7, 8, 10/11, Apple macOS, OS X, and Linux

13.6 Identify and describe the purpose of command prompt/line utilities
  13.6.1 PING, TRACERT, IPCONFIG, SFC, CHKDSK, TASKLIST, FORMAT, SYSTEMINFO, POWERCFG, SCHTASKS, Fdisk
  13.6.2 Identify procedures for locating, accessing and retrieving information through a command line

13.7 Perform common functions of Windows Desktop

13.8 Explain how and when Windows Debugger (WinDbg) is used

13.9 Explain the common steps in configuring Windows for Selective Startup and Networking

13.10 Describe the use of Windows File Explorer for file and folder management
  13.10.1 Identify how to use Windows File History
  13.10.2 Explain how Windows System File Checker (SFC) works

13.11 Explain how to use Windows Device Manager for installing and troubleshooting hardware

13.12 Explain Windows Registry Management as it pertains to editing, backup, and restoration
  13.12.1 Identify how Hive Key (HKEY) configurations are used

13.13 Define purposes and usage of Virtual Memory

13.14 Explain how to calculate and adjust Virtual Memory settings

13.15 Explain the purposes and usage of MSCONFIG.exe (Windows®)

13.16 Describe the purpose of and how System Restore is used in Windows 7 and 8

13.17 Describe Software Uninstall Procedures for Windows Applications

13.18 Describe Time Machine functions and procedures for Apple macOS and OS X

13.19 Explain how to use Linux Disk Management basics

13.20 Explain how to use Linux File Management commands

14.0 File Management

14.1 Explain how to format a hard disk drive

14.2 Explain the use of a primary partition

14.3 Explain the purpose of managing partitions:
  14.3.1 Logical
  14.3.2 Primary
  14.3.3 Extended

14.4 Describe the procedure used to partition a hard disk drive

14.5 Explain the partitioning/booting use of a:
  14.5.1 Master boot record (MBR)
  14.5.2 GUID Partition Table (GPT)
  14.5.3 GRand Unified Bootloader (GRUB), GRUB2
  14.5.4 LInux LOader (LILO)

14.6 List the managerial advantages and disadvantages of NTFS, FAT32, and exFAT
  14.6.1 macOS Extended (HFS+)
    14.6.1.1 Standard
    14.6.1.2 Journaled

14.7 Explain the procedures for directory (folder) creation and deletion

14.8 Describe procedures for file usage (saving, deleting, copying, moving, recovery)

14.9 Describe the defragmentation process, how it is accomplished and how often to use it

14.10 Describe how the Data Backup process works

14.11 Compare the various types of backups

End of Computer Service Technician Competencies Listings
NOTES: Suggested Prerequisite: Associate CET (CETA) or equivalent for basic electronics. CST’s may also pass the Associate CET exam and, by doing so, earn their Certified Electronics Technician (CET) designation (using the CST specialty area).

**Find An ETA Test Site:** [https://www.etai.org/test_sites.html](https://www.etai.org/test_sites.html)

**Suggested Additional Resource and Study Material:**

As with most computer hardware, you will find details and information on Websites:
- ieee.org; networkcomputing.com; pcworld.com; cnet.com; computerworld.com; pcmag.com; consumerreports.org; maximumpc.com; infoworld.com; intel.com; amd.com; Microsoft.com; itunes.apple.com; rmroberts.com; beyourownit.com; worldwidelearn.com; professormesser.com; youtube.com; and many, many other websites


**Upgrading and Repairing PCs, 22E:** Scott Mueller; QUE Publishing; ISBN 978-0789756107; April 2015; hardcover; 1200 pgs.

**Computer Service and Repair, 4E:** Richard Roberts; Goodheart-Willcox; ISBN 978-1619607958; April 2014; hardcover; 974 pgs.

**CST Committee Advisory Board:**

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