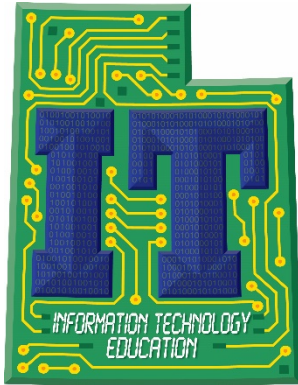


STRANDS AND STANDARDS

A+ COMPUTER MAINTENANCE & REPAIR



Course Description

Students will learn necessary competencies for an entry-level IT professional including installing, building, upgrading, repairing, configuring, troubleshooting, optimizing, diagnosing, and performing preventive maintenance of basic personal computer hardware and operating systems.

CompTIA Certification

To receive CompTIA A+ certification a candidate must pass two exams. The first exam is the CompTIA A+ 220-801 Certification Exam. The CompTIA A+ 220-802 Certification Exam is the second exam required in order for CompTIA A+ certification candidates to complete their certification.

A+ COMPUTER MAINTENANCE AND REPAIR

Intended Grade Level	10-12
Units of Credit	1.0
Core Code	35.01.00.00.040
Concurrent Enrollment Core Code	35.01.00.13.040
Prerequisite	Suggested Intro to IT, or Teacher Approval
Skill Certification Test Number	#884, CompTIA Strata IT Fundamentals (FCO-U41), CompTIA A+ Hardware (220-801), CompTIA A+ Operating System (220-802), TestOut PC Pro, HP ATA – connected Devices (HP4-A01), MTA Windows OS Fundamentals, MTA Networking Fundamentals (#98-366) MTA Security Fundamentals (#98-367)
Test Weight	1.0
License Type	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	A+ Computer Maintenance and Repair

Domain A+ 220-801	Percentage of Examination
1.0 PC Hardware	40%
2.0 Networking	27%
3.0 Laptops	11%
4.0 Printers	11%
5.0 Operational Procedures	11%
Total	100

Domain A+ 220-802	Percentage of Examination
6.0 Operating Systems	33%
7.0 Security	22%
8.0 Mobile Devices	9%
9.0 Troubleshooting	36%
Total	100%

STRAND 1

PC Hardware

Standard 1

Configure and apply BIOS Settings.

- Install firmware upgrades – flash BIOS
- BIOS component information
 - RAM
 - Hard drive
 - Optical drive
 - CPU
- BIOS configurations
 - Boot sequence
 - Enabling and disabling devices
 - Date/Time
 - Clock speeds
 - Virtualization support
 - BIOS security (passwords, drive encryption: TPM, lo-jack)
- Use built-in diagnostics
- Monitoring
 - Temperature monitoring
 - Fan speeds
 - Intrusion detection/notification
 - Voltage
 - Clock
 - Bus speed

Standard 2

Differentiate between motherboard components, their purposes, and properties.

- Sizes
 - ATX
 - Micro-ATX
 - ITX
- Expansion slots
 - PCI
 - PCI-X
 - PCIe
 - miniPCI
 - CNR
 - AGP2x, 4x, 8x
- RAM slots
- CPU sockets

- Chipsets
 - North Bridge
 - South Bridge
 - CMOS battery
- Jumpers
- Power connections and types
- Fan connectors
- Front panel connectors
 - USB
 - Audio
 - Power button
 - Power light
 - Drive activity lights
 - Reset button
- Bus speeds

Standard 3

Compare and contrast RAM types and features.

- Types
 - DDR
 - DDR2
 - SDRAM
 - SODIMM
 - DIMM
 - RAM configurations (Single channel vs dual channel vs triple channel)
- RAM compatibility and speed

Standard 4

Install and configure expansion cards.

- Sound cards
- Video cards
- Network cards
- Serial and parallel cards
- USB cards
- Firewire cards
- Storage cards
- Modem cards
- Wireless/cellular cards
- TV tuner cards
- Video capture cards
- Riser cards

Standard 5

Install and configure storage devices and use appropriate media.

- Optical drives
 - CD-ROM
 - DVD-ROM
 - Blu-Ray
- Combo drives and burners
 - CD-RW
 - DVD-RW
 - Dual Layer DVD-RW
 - BD-R
 - BD-RE
- Connection types
 - External (USB, Firewire, eSATA, Ethernet)
 - Internal SATA, IDE and SCSI (IDE configuration and setup (Master, Slave, Cable Select), SCSI IDs (0 – 15))
 - Hot swappable drives
- Hard drives
 - Magnetic
 - 5400 rpm
 - 7200 rpm
 - 10,000 rpm
 - 15,000 rpm
- Solid state/flash drives
 - Compact flash
 - SD
 - Micro-SD
 - Mini-SD
 - xD
 - SSD
- RAID types (0, 1, 5, 10)
- Media capacity
 - CD
 - CD-RW
 - DVD-RW
 - DVD
 - Blu-Ray
 - DL DVD

Standard 6

Differentiate among various CPU types and features and select the appropriate cooling method.

- Socket types
 - Intel: LGA, 775, 1155, 1156, 1366
 - AMD: 940, AM2, AM2+, AM3, AM3+, FM1, F
- Characteristics
 - Speeds
 - Cores
 - Cache size/type
 - Hyperthreading
 - Architecture (32-bit vs. 64-bit)
 - Integrated GPU
- Cooling
 - Heat sink
 - Fans
 - Thermal paste

Standard 7

Compare and contrast various connection interfaces and explain their purpose.

- Physical connections
 - USB 1.1 vs. 2.0 vs. 3.0 characteristics (Connector types: A, B, mini, micro)
 - Firewire characteristics
 - SATA1 vs. SATA2 vs. SATA3, eSATA, IDE speeds
 - Other connector types (Serial, Parallel, VGA, HDMI, DVI, Audio, RJ-45, RJ-11)
 - Analog vs. digital transmission, VGA vs. HDMI
- Speeds, distances and frequencies of wireless device connections
 - Bluetooth
 - RF (802.11)

Standard 8

Install an appropriate power supply based on a given scenario.

- Connector types and their voltages
 - SATA
 - Molex
 - 4/8-pin 12v
 - PCIe 6/8-pin
 - 20-pin
 - 24-pin
 - Floppy
- Specifications
 - Wattage
 - Size

- Number of connectors
 - ATX
 - Micro-ATX
- Dual voltage options

Standard 9

Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs.

- Graphic / CAD / CAM design workstation
- Audio/Video editing workstation
- Virtualization workstation
- Gaming PC
- Home Theater PC
- Standard thick client
- Thin client
- Home Server PC

Standard 10

Given a scenario, evaluate types and features of display devices.

- Types
 - CRT
 - LCD
 - LED
 - Projector
- Resolution
- Native resolution
- Analog vs. digital
- Privacy/antiglare filters
- Multiple displays

Standard 11

Identify connector types and associated cables.

- Display connector types
 - DVI-D
 - DVI-I
 - DVI-A
 - DisplayPort
 - HD15 (i.e. DE15 or DB15)
 - miniHDMI
 - RJ-45
 - miniDin-6
- Display cable types
 - HDMI

- DVI
- VGA
- Component
- Composite
- S-video
- Coaxial
- Ethernet
- Device connectors and pin arrangements
 - SATA
 - eSATA
 - PATA
 - IDE
 - EIDE
 - USB
 - IEEE1394
 - SCSI
 - PS/2
 - Parallel
 - Serial
 - Audio
 - RJ-45
- Device cable types
 - SATA
 - eSATA
 - IDE
 - EIDE
 - Floppy
 - USB
 - IEEE1394
 - SCSI (68pin vs. 50pin vs. 25pin)
 - Parallel
 - Serial
 - Ethernet
 - Phone

Standard 12

Install and configure various peripheral devices.

- Input devices
 - Mouse
 - Keyboard
 - Microphone
- Output devices

- Printers
- Speakers
- Display devices

STRAND 2

Networking

Standard 1

Identify types of network cables and connectors.

- Twisted Pair
 - Connectors: RJ-11, RJ-45
 - Wiring standards: T568A, T568B

Standard 2

Categorize characteristics of connectors and cabling.

- Twisted pair
 - Types: STP, UTP, CAT3, CAT5, CAT5e, CAT6, plenum, PVC
 - Speed and transmission limitations

Standard 3

Explain properties and characteristics of TCP/IP.

- IP class
 - Class A
 - Class B
 - Class C
- IPv4 vs. IPv6
- Public vs. private vs. APIPA
- Static vs. dynamic
- Client-side DNS
- DHCP
- Subnet mask
- Gateway

Standard 4

Explain common TCP and UDP ports, protocols, and their purpose.

- Ports
 - 21 – FTP
 - 23 – TELNET
 - 25 – SMTP
 - 53 – DNS
 - 80 – HTTP
 - 110 – POP3
 - 143 – IMAP

- 443 – HTTPS
- 3389 – RDP
- Protocols
 - DHCP
 - DNS
 - LDAP
 - SNMP
 - SMB
 - SSH
 - SFTP
- TCP vs. UDP

Standard 5

Compare and contrast wireless networking standards and encryption types.

- Standards
 - 802.11 a/b/g/n
 - Speeds, distances and frequencies
- Encryption types
 - WEP, WPA, WPA2, TKIP, AES

Standard 6

Install, configure, and deploy a SOHO wireless/wired router using appropriate settings.

- MAC filtering
- Channels (1 – 11)
- Port forwarding, port triggering
- SSID broadcast (on/off)
- Wireless encryption
- Firewall
- DHCP (on/off)
- DMZ
- NAT

Standard 7

Compare and contrast Internet connection types and features.

- Cable
- DSL
- Dial-up
- Fiber
- Cellular (mobile hotspot)

Standard 8

Identify various types of networks.

- LAN
- WAN
- PAN
- MAN
- Topologies
 - Ring
 - Bus
 - Star
 - Hybrid

Standard 9

Compare and contrast network devices their functions and features.

- Hub
- Switch
 - PoE
- Router
- Access point
- Bridge
- Modem
- NAS
- Firewall
- VoIP phones
- Internet appliance

Standard 10

Given a scenario, use appropriate networking tools.

- Crimper
- Multimeter
- Toner probe
- Cable tester
- Loopback plug
- Punchdown tool

STRAND 3

Printers

Standard 1

Explain the differences between the various printer types and summarize the associated imaging process.

- Laser

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- Imaging drum, fuser assembly, transfer belt, transfer roller, pickup rollers, separate pads, duplexing assembly
- Imaging process: processing, charging, exposing, developing, transferring, fusing and cleaning
- Inkjet
 - Ink cartridge print head, roller, feeder, duplexing assembly, carriage and belt
 - Calibration
- Thermal
 - Feed assembly, heating element
 - Special thermal paper

Standard 2

Given a scenario, install, and configure printers.

- Use appropriate printer drivers for a given operating system
- Print device sharing
 - Wired (USB, Parallel, Ethernet)
 - Wireless (802.11x)
 - Printer hardware print server
- Printer sharing
 - Sharing local/networked printer via Operating System settings

Standard 3

Given a scenario, perform printer maintenance.

- Laser
 - Replacing toner, applying maintenance kit, calibration, cleaning

STRAND 4

Operational Procedures

Standard 1

Given a scenario, use appropriate safety procedures.

- ESD straps
- ESD mats
- Self-grounding
- Equipment grounding
- Personal safety
 - Disconnect power before repairing PC
 - Remove jewelry
 - Lifting techniques
 - Weight limitations
 - Electrical fire safety
 - CRT safety – proper disposal
 - Cable management

- Compliance with local government regulations

Standard 2

Explain environmental impacts and the purpose of environmental controls.

- MSDS documentation for handling and disposal
- Power surges, brownouts, blackouts
 - Battery backup
 - Surge suppressor
- Dust and debris
 - Compressed air
 - Vacuums
- Component handling and protection
 - Antistatic bags
- Compliance to local government regulations

Standard 3

Given a scenario, demonstrate proper communication and professionalism.

- Use proper language – avoid jargon, acronyms, slang when applicable
- Maintain a positive attitude
- Listen and do not interrupt the customer
- Be culturally sensitive
- Be on time (if late contact the customer)
- Avoid distractions
 - Personal calls
 - Talking to co-workers while interacting with customers
 - Personal interruptions
- Dealing with difficult customer or situation
 - Avoid arguing with customers and/or being defensive
 - Do not minimize customer's problems
 - Avoid being judgmental
 - Clarify customer statements (ask open ended questions to narrow the scope of the problem, restate the issue or question to verify understanding)
- Set and meet expectations/timeline and communicate status with the customer
 - Offer different repair/replacement options if applicable
 - Provide proper documentation on the services provided
 - Follow up with customer/user at a later date to verify satisfaction
- Deal appropriately with customers confidential materials
 - Located on a computer, desktop, printer, etc

Standard 4

Explain the fundamentals of dealing with prohibited content/activity.

- First response
 - Identify
 - Report through proper channels
 - Data/device preservation

- Use of documentation/documentation changes
- Chain of custody
 - Tracking of evidence/documenting process

STRAND 5

Operating Systems

Standard 1

Compare and contrast the features and requirements of various Microsoft Operating Systems.

- Windows XP Home, Windows XP Professional, Windows XP Media Center, Windows XP 64-bit Professional
- Windows Vista Home Basic, Windows Vista Home Premium, Windows Vista Business, Windows Vista Ultimate, Windows Vista Enterprise
- Windows 7 Starter, Windows 7 Home Premium, Windows 7 Professional, Windows 7 Ultimate, Windows 7 Enterprise
- Features:
 - 32-bit vs. 64-bit
 - Aero, gadgets, user account control, bit-locker, shadow copy, system restore, ready boost, sidebar, compatibility mode, XP mode, easy transfer, administrative tools, defender, Windows firewall, security center, event viewer, file structure and paths, category view vs. classic view
- Upgrade paths – differences between in place upgrades, compatibility tools, Windows upgrade OS advisor

Standard 2

Given a scenario, install, and configure the operating system using the most appropriate method.

- Boot methods
 - USB
 - CD-ROM
 - DVD
 - PXE
- Type of installations
 - Creating image
 - Unattended installation
 - Upgrade
 - Clean install
 - Repair installation
 - Multiboot
 - Remote network installation
 - Image deployment
- Partitioning
 - Dynamic

- Basic
- Primary
- Extended
- Logical
- File system types/formatting
 - FAT32
 - NTFS
 - CDFS
 - Quick format vs. full format
- Load alternate third party drivers when necessary
- Workgroup vs. Domain setup
- Driver installation, software and windows updates
- Factory recovery partition

Standard 3

Given a scenario, use appropriate command line tools.

- Networking
 - PING
 - TRACERT
 - IPCONFIG
 - NSLOOKUP
- OS
 - MD
 - RD
 - CD
 - DEL
 - FDISK
 - FORMAT
 - COPY
 - XCOPY
 - CHKDSK
 - [command name] /?
- Recovery Console
 - Fixboot
 - Fixmbr

Standard 4

Given a scenario, use appropriate operating system features and tools.

- Administrative
 - Computer management
 - Device manager
 - Users and groups
 - Local security policy

- Performance monitor
- Services
- System configuration
- Component services
- Windows firewall
- Advanced security
- MSCONFIG
 - General
 - Boot
 - Service
 - Startup
 - Tools
- Task Manager
 - Applications
 - Processes
 - Performance
 - Networking
 - Users
- Run line utilities
 - MSCONFIG
 - REGEDIT
 - CMD
 - SERVICES.MSC
 - MMC
 - MSTSC
 - NOTEPAD
 - EXPLORER
 - MSINFO32

Standard 5

Given a scenario, use Control Panel utilities (the items are organized by “classic view/large icons” in Windows).

- Common to all Microsoft Operating Systems
 - Internet options (Security, General, Privacy, Advanced)
 - Display (Resolution)
 - User accounts
 - Folder options (Sharing, View hidden files, Hide extensions, Layout)
 - System (Performance (virtual memory), Hardware profiles, Remote settings, Windows firewall)
 - Power options (Hibernate, Power plans, Sleep/suspend, Standby)
- Unique to Windows XP
 - Add/remove programs

- Network connections
- Printers and faxes
- Automatic updates
- Network setup wizard
- Unique to Windows 7
 - HomeGroup
 - Action center
 - Remote applications and desktop applications
 - Troubleshooting

Standard 6

Setup and configure Windows networking on a client/desktop.

- HomeGroup, file/print sharing
- WorkGroup
- Network shares/mapping drives
- Establish networking connections
 - VPN
 - Dialups
 - Wireless
 - Wired
 - WWAN (Cellular)
- Proxy settings
- Remote desktop
- Home vs. Work vs. Public network settings
- Firewall settings
 - Exceptions
 - Configuration
 - Enabling/disabling Windows firewall
- Network card properties
 - Half duplex/full duplex/auto
 - Speed
 - Wake-on-LAN

Standard 7

Perform preventive maintenance procedures using appropriate tools.

- Best practices
 - Windows updates
 - Antivirus updates
- Tools
 - Check disk
 - Defrag

Standard 8

Explain the differences among basic OS security settings.

- User and groups
 - Administrator
 - Power user
 - Guest
 - Standard user
- NTFS vs. Share permissions
 - Allow vs. deny
 - Moving vs. copying folders and files
 - File attributes
- System files and folders

STRAND 6

Security

Standard 1

Apply and use common prevention methods.

- Physical security
 - Lock doors
 - Tailgating
 - Securing physical documents/passwords/shredding
 - Badges
 - Windows
- Digital security
 - Antivirus
 - Firewalls
 - Antispyware
 - User authentication/strong passwords
 - Directory permissions
- User education
- Principle of least privilege

Standard 2

Compare and contrast common security threats.

- Social engineering
- Malware
- Rootkits
- Phishing
- Shoulder surfing
- Spyware
- Viruses

- Worms
- Trojans

Standard 3

Implement security best practices to secure a workstation.

- Setting strong passwords
- Requiring passwords

Standard 4

Given a scenario, use the appropriate data destruction/disposal method.

- Low level format vs. standard format
- Hard drive sanitation and sanitation methods
 - Overwrite
 - Drive wipe
- Physical destruction
 - Shredder
 - Drill
 - Electromagnetic
 - Degaussing tool

Standard 5

Given a scenario, secure a SOHO wireless network.

- Change default user-names and passwords
- Changing SSID
- Setting encryption
- Disabling SSID broadcast
- Enable MAC filtering

Standard 6

Given a scenario, secure a SOHO wired network.

- Change default usernames and passwords
- Enable MAC filtering
- Assign static IP addresses
- Disabling ports
- Physical security

STRAND 7

Troubleshooting

Standard 1

Given a scenario, explain the troubleshooting theory.

- Identify the problem
 - Question the user and identify user changes to the computer and perform backups before making changes

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- Establish a theory of probable cause (question the obvious)
- Test the theory to determine cause
 - Once theory is confirmed determine next steps to resolve problem
 - If theory is not confirmed re-establish new theory or escalate
- Establish a plan of action to resolve the problem and implement the solution
- Verify full system functionality and if applicable implement preventive measures
- Document findings, actions and outcomes

Standard 2

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

- Common symptoms
 - Unexpected shutdown
 - POST code beeps
 - Blank screen on bootup
 - BIOS time and settings resets
 - Attempts to boot to incorrect device
 - No power
 - Loud noise
 - Fans spin – no power to other devices
 - Indicator lights
 - BSOD
- Tools
 - Multimeter
 - Power supply tester

Standard 3

Given a scenario, troubleshoot hard drives with appropriate tools.

- Common symptoms
 - Loud clicking noise
 - Failure to boot
 - Drive not recognized
- Tools
 - Screwdriver
 - External enclosures
 - CHKDSK
 - FORMAT
 - FDISK
 - File recovery software

Standard 4

Given a scenario, troubleshoot common video and display issues.

- Common symptoms

- VGA mode
- No image on screen
- Overheat shutdown
- Dead pixels
- Artifacts
- Color patterns incorrect
- Dim image
- Flickering image
- Distorted image
- Discoloration (degaussing)
- BSOD

Standard 5

Given a scenario, troubleshoot wired and wireless networks with appropriate tools.

- Common symptoms
 - No connectivity
 - APIPA address
 - Limited connectivity
 - Local connectivity
 - Intermittent connectivity
 - IP conflict
- Tools
 - Cable tester
 - Loopback plug
 - Punch down tools
 - Toner probes
 - Wire strippers
 - Crimpers
 - PING
 - IPCONFIG

Standard 6

Given a scenario, troubleshoot operating system problems with appropriate tools.

- Common symptoms
 - BSOD
 - Failure to boot
 - Improper shutdown
 - Spontaneous shutdown/restart
 - Device fails to start
 - Missing dll message
 - Service fails to start
 - Compatibility error
 - Slow system performance

- Boots in safe mode
- Fails fails to open
- Missing NTLDR
- Missing Boot.ini
- Missing operating system
- Invalid boot disk
- Tools
 - Fixboot
 - Recovery console
 - Fixmbr
 - MSCONFIG
 - DEFRAG
 - Event viewer
 - Safe mode
 - Command prompt

Standard 7

Given a scenario, troubleshoot common security issues with appropriate tools and best practices.

- Common symptoms
 - Browser redirection
 - Security alerts
 - Slow performance
 - Internet connectivity issues
 - PC Locks up
 - Windows updates failures
 - Rouge antivirus
 - Spam
 - Renamed system files
 - Files disappearing
 - File permission changes
 - Hijacked email
 - Access denied
- Tools
 - Anti-virus software
 - Anti-malware software
 - Anti-spyware software
 - Event viewer
- Best practices for malware removal
 - Identify malware symptoms
 - Quarantine infected system
 - Disable system restore

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- Remediate infected systems (Update anti-virus software, Scan and removal techniques (safe mode, pre-installation environment)
- Schedule scans and updates
- Enable system to restore and create restore point
- Educate end user

Standard 8

Given a scenario, troubleshoot, and repair common laptop issues while adhering to the appropriate procedures. (Deleted)

Standard 9

Given a scenario, troubleshoot printers with appropriate tools

- Common symptoms
 - Streaks
 - Faded prints
 - Ghost images
 - Paper jam
 - No connectivity
 - Garbled characters on paper
 - Printer will not print

Performance Skills

Remote support from an external location, assisting with software, hardware and operating systems installations, include troubleshooting, ask client/customer various questions about the installed computer systems, run diagnostic, handle software security. Highlight customer service and listening skills to understand a customer's problem so that student can help them, even when they are frustrated. Problem-solving skills are paramount so that you can figure out exactly what is causing the tricky hardware and software issues.

Work Place Skills

Communication, Problem Solving, Teamwork, Critical Thinking, Dependability, Accountability, Legal requirements/expectations

Skill Certificate Test Points by Strand

Test Name	Test #	Number of Test Points by Strand										Total Points	Total Questions
		1	2	3	4	5	6	7	8	9	10		
Computer Maintenance & Repair (A+)	884	23	7	10	17	3	6					66	61