Computer Networking
Hardware Operations I

8542/18 weeks

Table of Contents

Acknowledgments 2
Course Description 3
Task Essentials Table 3
Curriculum Framework 6
Exploring Personal Computer (PC) Hardware 6
Assembling a PC 6
Understanding Advanced Computer Hardware 7
Performing Preventive Maintenance and Troubleshooting 8
Describing Networking Concepts 9
Configuring Devices to Communicate on a Network 10
Exploring Laptops and Other Mobile Devices 10
Installing Printers 12
Describing Virtualization and Cloud Computing 13
Installing Windows Operating Systems (OS) 13
Configuring Windows 14
Exploring Mobile, Linux, and OSX Operating Systems 16
Implementing Basic Host, Data, and Network Security 17
Describing Professional Roles and Responsibilities in IT 19
SOL Correlation by Task 20
Teacher Resources 23
Appendix: Credentials, Course Sequences, and Career Cluster Information 26
Acknowledgments

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Virginia Department of Education

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Suggested Grade Level: 10 or 11
This course is designed for students who wish to pursue careers in information technology (IT). Students who complete this course will be able to describe the internal components of a computer, assemble a computer system, install operating systems (OS), and troubleshoot these using software tools and diagnostics. The course covers the fundamentals of computer hardware and software and advanced concepts such as security, networking, scripting basics, remote access technology use, Internet of Things (IoT) device configuration, documentation and change-management best practices, disaster prevention and recovery methods, virtualization, and cloud computing. This course helps prepare students for the CompTIA A+ Certification Exam.

**Task Essentials Table**

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential.
- Tasks/competencies designated by empty-circle icons (○) are optional.
- Tasks/competencies designated by minus icons (⊖) are omitted.
- Tasks marked with an asterisk (*) are sensitive.

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exploring Personal Computer (PC) Hardware</strong></td>
<td></td>
</tr>
<tr>
<td>⊕</td>
<td>Describe PC components.</td>
</tr>
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</tr>
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<td></td>
</tr>
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<td>Install components.</td>
</tr>
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</tr>
<tr>
<td><strong>Understanding Advanced Computer Hardware</strong></td>
<td></td>
</tr>
<tr>
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<td>Describe the boot-up process.</td>
</tr>
<tr>
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</tr>
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<td>Configure a computer.</td>
</tr>
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<td></td>
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<td>Perform preventive maintenance.</td>
</tr>
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<td>Troubleshoot PCs.</td>
</tr>
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<td><strong>Describing Networking Concepts</strong></td>
<td></td>
</tr>
<tr>
<td>⊕</td>
<td>Describe computer networks.</td>
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</tbody>
</table>
Describe networking protocols, standards, and services.
Describe network devices.
Describe network cables.

Configuring Devices to Communicate on a Network
Configure devices.
Describe the basic troubleshooting processes for networks.

Exploring Laptops and Other Mobile Devices
Describe laptops and other mobile devices.
Describe laptop configuration.
Describe laptop hardware and component installation and configuration.
Describe other mobile device hardware.
Configure network connectivity and email.
Perform preventive maintenance.
Describe troubleshooting for laptops and other mobile devices.

Installing Printers
Identify common printer features.
Compare printers.
Install a printer.
Configure printer sharing.
Describe printer maintenance and troubleshooting.

Describing Virtualization and Cloud Computing
Describe virtualization.
Describe cloud computing.

Installing Windows Operating Systems (OS)
Describe modern OS.
Describe disk management.
Install a Windows OS.

Configuring Windows
Configure Windows Desktop and File Explorer.
Configure Windows using Control Panels.
Manage a Windows system.
Use command-line tools.
Perform Windows networking.
Perform preventive maintenance.
Perform troubleshooting processes.

Exploring Mobile, Linux, and OSX Operating Systems
- Describe mobile OS.
- Identify methods for securing mobile devices.
- Describe Linux and macOS operating systems.
- Describe how to troubleshoot other OS.

Implementing Basic Host, Data, and Network Security
- Describe security threats.
- Explain security procedures.
- Secure Windows workstations.
- Configure wireless security.
- Explain the troubleshooting process for security.

Describing Professional Roles and Responsibilities in IT
- Identify communication skills.
- Manage operational procedures.
- Describe ethical and legal considerations in IT.
- Describe the role of call center technicians.

Curriculum Framework

Exploring Personal Computer (PC) Hardware

Task Number 39
Describe PC components.
Definition

Description should include features and functions of components and how these work together.

**Task Number 40**

**Select PC components.**

**Definition**

Selection should include appropriate components to build, repair, or upgrade PCs.

**Task Number 41**

**Disassemble a PC.**

**Definition**

Disassembly should include safely removing components.

**Assembling a PC**

**Task Number 42**

**Install components.**

**Definition**

Installation should include using components to build, repair, or upgrade PCs.

**Task Number 43**

**Assemble a computer.**

**Definition**

Assembly should include correct selection and installation of components.
Understanding Advanced Computer Hardware

Task Number 44

Describe the boot-up process.

Definition

Description should include an explanation of how to verify Basic Input/Output System (BIOS) and Unified Extensible Firmware Interface (UEFI) settings.

Task Number 45

Describe electrical power.

Definition

Description should include

- explaining how electricity powers a computer
- using Ohm’s law to determine the power requirements for a PC, based on its accessories and components.

Task Number 46

Explain computer functionality.

Definition

Explanation should include advanced functionalities.

Task Number 47

Configure a computer.

Definition
Configuration should include selecting components to upgrade a computer to meet requirements.

**Task Number 48**

Dispose of electronic components in a way that protects the environment.

**Definition**

Disposal should include a description of the necessary procedures for disposing of electronic components in an environmentally responsible manner.

**Performing Preventive Maintenance and Troubleshooting**

**Task Number 49**

Perform preventive maintenance.

**Definition**

Performance should include explaining the purpose of preventive maintenance on PCs.

**Task Number 50**

Troubleshoot PCs.

**Definition**

Troubleshooting should include addressing problems with PCs and peripheral devices.

**Describing Networking Concepts**

**Task Number 51**
Describe computer networks.

Definition

Description should include the types of computer networks and the components of each.

Task Number 52

Describe networking protocols, standards, and services.

Definition

Description should differentiate among protocols, standards, and services.

Task Number 53

Describe network devices.

Definition

Description should include the purposes of devices on a network.

Task Number 54

Describe network cables.

Definition

Description should include building a network cable.

Configuring Devices to Communicate on a Network

Task Number 55

Configure devices.
Definition

Configuration should include devices for wired and wireless networks.

Task Number 56
Describe the basic troubleshooting processes for networks.

Definition

Description should include troubleshooting problems and solutions related to networks.

Exploring Laptops and Other Mobile Devices

Task Number 57
Describe laptops and other mobile devices.

Definition

Description should include features and functions.

Task Number 58
Describe laptop configuration.

Definition

Description should include power settings and wireless settings.

Task Number 59
Describe laptop hardware and component installation and configuration.

Definition
Description should include procedure for installing, configuring, and removing laptop components.

**Task Number 60**

**Describe other mobile device hardware.**

**Definition**

Description should include characteristics and purposes.

**Task Number 61**

**Configure network connectivity and email.**

**Definition**

Configuration should include network connectivity and email on mobile devices.

**Task Number 62**

**Perform preventive maintenance.**

**Definition**

Performance should include common preventive maintenance techniques for laptops and other mobile devices.

**Task Number 63**

**Describe troubleshooting for laptops and other mobile devices.**

**Definition**

Description should include troubleshooting processes for various mobile devices.
Installing Printers

Task Number 64
Identify common printer features.

Definition
Identification should include types of printers and their purposes and characteristics.

Task Number 65
Compare printers.

Definition
Comparison should include various types of printers.

Task Number 66
Install a printer.

Definition
Installation should include configuration for functionality.

Task Number 67
Configure printer sharing.

Definition
Configuration should meet requirements.

Task Number 68
Describe printer maintenance and troubleshooting.
Definition

Description should include how to improve printer availability.

**Describing Virtualization and Cloud Computing**

**Task Number 69**

Describe virtualization.

**Definition**

Description should include cloud and virtualization concepts.

Teacher Resource: [Cloud and Virtualization Concepts, NDG](#)

**Task Number 70**

Describe cloud computing.

**Definition**

Description should include a comparison of cloud computing concepts.

Teacher Resource: [Cloud and Virtualization Concepts, NDG](#)

**Installing Windows Operating Systems (OS)**

**Task Number 71**

Describe modern OS.

**Definition**

Description should include system requirements.
Task Number 72
Describe disk management.

Definition
Description should include creating a partition in Windows using the Disk Management Utility.

Task Number 73
Install a Windows OS.

Definition
Installation should include boot sequence and updating.

Configuring Windows

Task Number 74
Configure Windows Desktop and File Explorer.

Definition
Configuration should include performing management and maintenance.

Task Number 75
Configure Windows using Control Panels.

Definition
Configuration should include performing management and maintenance.

Task Number 76
Manage a Windows system.
Definition

Management should include using Windows tools and utilities for system administration.

**Task Number 77**

**Use command-line tools.**

Definition

Use should include Windows command-line tools.

**Task Number 78**

**Perform Windows networking.**

Definition

Performance should include configuring a Windows computer to work on a network.

**Task Number 79**

**Perform preventive maintenance.**

Definition

Performance should include common preventive maintenance techniques on a computer using Microsoft Windows tools.

**Task Number 80**

**Perform troubleshooting processes.**

Definition

Performance should include identifying the troubleshooting process for a Microsoft Windows OS.
Exploring Mobile, Linux, and OSX Operating Systems

Task Number 81
Describe mobile OS.

Definition
Description should include purposes and characteristics.

Teacher Resources:
Cyber Basics – Module O: Introduction to Linux, Virginia Cyber Range
Linux Unhatched, NDG

Task Number 82
Identify methods for securing mobile devices.

Definition
Identification should include methods for securing mobile devices and relevant examples.

Teacher Resources:
Cyber Basics – Module O: Introduction to Linux, Virginia Cyber Range
Linux Unhatched, NDG

Task Number 83
Describe Linux and macOS operating systems.

Definition
Description should include purposes and characteristics.
Task Number 84
Describe how to troubleshoot other OS.

Definition

Description should include basic processes used for

- mobile
- Linux
- macOS.

Implementing Basic Host, Data, and Network Security

Task Number 85
Describe security threats.

Definition

Description should include threats to

- host
- data
- network.
Task Number 86

Explain security procedures.

Definition

Explanation should include procedures related to

- host
- data
- network.

Task Number 87

Secure Windows workstations.

Definition

Securing should include configuration of basic security settings and policies for end devices.

Task Number 88

Configure wireless security.

Definition

Configuration should include applying concepts of wireless security.

Task Number 89

Explain the troubleshooting process for security.

Definition

Explanation should include the six steps of the troubleshooting process for security.
Describing Professional Roles and Responsibilities in IT

Task Number 90
Identify communication skills.

Definition
Identification includes the importance of communication skills as a critical part of IT work.

Task Number 91
Manage operational procedures.

Definition
Management includes dealing with change and disruptions in a business environment.

Task Number 92
Describe ethical and legal considerations in IT.

Definition
Description should include appropriate behavior when faced with ethical and/or legal issues in the IT industry.

Task Number 93
Describe the role of call center technicians.

Definition
Description should include the call center environment and technician responsibilities therein.
<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Language</th>
<th>Mathematics</th>
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<tbody>
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<td></td>
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<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
</tr>
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<td></td>
</tr>
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<td>Mathematics: AII.3</td>
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<td></td>
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<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>56</td>
<td>Describe the basic troubleshooting processes for networks.</td>
<td>Exploring Laptops and Other Mobile Devices</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>57</td>
<td>Describe laptops and other mobile devices.</td>
<td></td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>58</td>
<td>Describe laptop configuration.</td>
<td></td>
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</tr>
<tr>
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<td>Identify common printer features.</td>
<td></td>
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<td></td>
<td>Mathematics: COM.11</td>
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</tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>Configure printer sharing.</td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>72</td>
<td>Describe disk management.</td>
<td></td>
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</tr>
<tr>
<td>73</td>
<td>Install a Windows OS.</td>
<td>Configuring Windows</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Configure Windows Desktop and File Explorer.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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Teacher Resources

Acronym Glossary

AAA    authentication, authorization, and accounting
ACL    access control list
API    application programming interfaces
ARP    Address Resolution Protocol
BIOS   basic input/output system
BPDU   bridge protocol data unit
BYOD   bring your own device
CAPWAP control and provisioning of wireless access points
CDP    Cisco Discovery Protocol
CLI    command-line interface
DHCP   dynamic host configuration protocol
DNA    (Cisco) Digital Network Architecture
DNS    Domain Name Service
DR/BDR designated router/backup designated router
DTP    Dynamic Trunking Protocol
FHRP   first hop redundancy protocol
FTP    file transfer protocol
GUA    global unicast address
HSRP   Hot Standby Router Protocol
IBN    intent-based networking
ICMP   Internet Control Messaging Protocol
ICT    information and communications technology
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>IOS</td>
<td>(Cisco) Internetwork Operating System</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
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<tr>
<td>IP</td>
<td>Internet Protocol</td>
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<tr>
<td>IPsec</td>
<td>IP security</td>
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<td>IT</td>
<td>information technology</td>
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<td>JSON</td>
<td>JavaScript object notation</td>
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<tr>
<td>LAN</td>
<td>local area network</td>
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<td>LLA</td>
<td>link-local address</td>
</tr>
<tr>
<td>LLDP</td>
<td>link layer discovery protocol</td>
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<tr>
<td>LSA</td>
<td>link state advertisement</td>
</tr>
<tr>
<td>LSU</td>
<td>link state update</td>
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<tr>
<td>MAC</td>
<td>media access control</td>
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<tr>
<td>NAT</td>
<td>network address translation</td>
</tr>
<tr>
<td>NTP</td>
<td>network time protocol</td>
</tr>
<tr>
<td>OSI</td>
<td>Open Systems Interconnection</td>
</tr>
<tr>
<td>OSPF</td>
<td>open shortest path first</td>
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<tr>
<td>PAT</td>
<td>port address translation</td>
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<tr>
<td>PC</td>
<td>personal computer</td>
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<td>PDU</td>
<td>protocol data unit</td>
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<td>PSK</td>
<td>pre-shared key</td>
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<tr>
<td>QoS</td>
<td>quality of service</td>
</tr>
<tr>
<td>REST</td>
<td>representational state transfer</td>
</tr>
<tr>
<td>SLAAC</td>
<td>stateless address autoconfiguration</td>
</tr>
<tr>
<td>SMB</td>
<td>service message block</td>
</tr>
<tr>
<td>SNMP</td>
<td>simple network management protocol</td>
</tr>
<tr>
<td>STP</td>
<td>spanning tree protocol</td>
</tr>
<tr>
<td>STP</td>
<td>Shielded Twisted Pair</td>
</tr>
<tr>
<td>syslog</td>
<td>System Logging Protocol</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>TCP</td>
<td>transmission control protocol</td>
</tr>
<tr>
<td>UDP</td>
<td>user datagram protocol</td>
</tr>
<tr>
<td>UEFI</td>
<td>Unified Extensible Firmware Interface</td>
</tr>
<tr>
<td>UTP</td>
<td>unshielded twisted pair</td>
</tr>
<tr>
<td>VLAN</td>
<td>virtual local area network</td>
</tr>
<tr>
<td>VLSM</td>
<td>variable-length subnet masking</td>
</tr>
<tr>
<td>VPN</td>
<td>virtual private network</td>
</tr>
<tr>
<td>VTY</td>
<td>virtual terminal line</td>
</tr>
<tr>
<td>WAN</td>
<td>wide area network</td>
</tr>
<tr>
<td>WLAN</td>
<td>wireless local area network</td>
</tr>
<tr>
<td>WLC</td>
<td>wireless LAN controller</td>
</tr>
<tr>
<td>WPA</td>
<td>Wi-Fi protected access</td>
</tr>
<tr>
<td>XML</td>
<td>extensible markup language</td>
</tr>
<tr>
<td>YAML</td>
<td>yet another markup language</td>
</tr>
</tbody>
</table>
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- A+ Certification Examination
- Cisco Certified CyberOps Associate Examination
- Cisco Certified DevNet Associate Examination
- Cisco Certified Networking Associate (CCNA) Examination
- Cisco Certified Networking Professional (CCNP) Automation for Cisco Enterprise Solutions Examination
- Cisco Certified Networking Professional (CCNP) Cisco Enterprise Networks Examination
- Cisco Certified Networking Professional (CCNP) Cisco SD-WAN Solutions Examination
- Cisco Certified Networking Professional (CCNP) Designing Enterprise Wireless Networks Examination
- Cisco Certified Networking Professional (CCNP) Enterprise Advanced Routing and Services Examination
- Cisco Certified Networking Professional (CCNP) Enterprise Network Core Technologies Examination
- Cisco Certified Networking Professional (CCNP) Implementing Enterprise Wireless Networks Examination
- College and Work Readiness Assessment (CWRA+)
- Computer Networking Fundamentals Assessment
- Customer Service Specialist (CSS) Examination
- Internetworking Examination
- IT Fundamentals+ Certification Examination
- Microsoft Technology Associate (MTA) Examinations
- Network Administration Certification Tests
- Network+ Certification Examination
- Professional Communications Certification Examination
- Security+ Certification Examination
- Technical Support Certification Tests
- Workplace Readiness Skills for the Commonwealth Examination

Concentration Sequences

A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.
- Computer Networking Hardware Operations II (8543/18 weeks, 70 hours)
- Computer Networking Hardware Operations III (8544/18 weeks, 70 hours)
- Computer Networking Hardware Operations IV (8545/18 weeks, 70 hours)

### Career Clusters, Pathways, and Occupations

<table>
<thead>
<tr>
<th>Career Cluster: Information Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pathway</strong></td>
</tr>
</tbody>
</table>
| Information Support and Services | Applications Integrator  
Computer Support Specialist  
Computer Systems Engineer, Architect  
Database Administrator  
Database Analyst  
Information Systems Analyst  
Information Systems Security Developer  
Information Systems Security Manager  
Maintenance Technician  
Network Systems and Data Communication Analyst  
Software Test Engineer  
Systems Analyst  
Technical Writer |
| Network Systems | Computer and Information Systems Administrator  
Computer Operator  
Computer Security Specialist  
Computer Software Engineer  
Computer Support Specialist  
Computer Systems Engineer, Architect  
Database Analyst  
Information Security Analyst  
Network and Computer Systems Administrator  
Network Architect  
Network Systems and Data Communication Analyst  
Software Test Engineer  
Systems Analyst  
Telecommunications Equipment Installer, Repairer  
Telecommunications Specialist |
| Programming and Software Development | Computer Software Engineer  
Information Security Analyst |
| Network Systems and Data Communication | Analyst  
|----------------------------------------|---------  
| Programmer                             |          
| Project Manager                        |          
| Software Applications Engineer         |          
| Software Test Engineer                 |          
| Systems Analyst                        |          
| Web and Digital Communications         |  
| Computer Support Specialist            |          
| Computer Systems Engineer, Architect   |          
| Project Manager                        |          
| Software Test Engineer                 |          
| Systems Analyst                        |         |