

**Information Technology**  
**Grade 12 Curriculum**  
CIP Code: 150303 (electronics)

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## **Program Philosophy**

The demand for information technology (IT) support in the global business world has exploded at an exponential rate. Students in the McCann Information Technology program will attain skills in networking, computer maintenance, web design and computer programming to support this demand. While this program has been designed to meet the standards identified in the Massachusetts VTE Frameworks for Information Support Services and Networking, the main goals of this program are to provide local industry with skilled IT employees. Employability skills as identified by the 1992 SCANS report are fully implemented by the Skills USA Professional Development Program. Additionally, the students will be provided the opportunity to test for national certifications in computer maintenance technology and networking. In order to meet these goals, the program must incorporate additional competencies and expand upon the standards in the frameworks. The resulting graduate students will be valuable workplace assets with the ability to self-learn and solve real world problems.

## **Course Description**

The senior students will continue with the last two Cisco Networking Academy modules: CCNA3 and CCNA4. CCNA3 focuses on advanced switch configuration.. Students are expected to apply information from CCNA1 and 2 to a network, and to explain how and why a particular strategy is employed. In the final module of the Cisco Networking Academy, CCNA4, the students will learn to implement Wide Area Network technologies and network management methods.

The Cisco Academy student is prepared for the Cisco Certified Networking Associate certification established by Cisco Systems Inc. The instructors are A+ certified, and have met the requirements to become certified for the Cisco Networking Academy, and will be taking the CCNA exam to complete the final process during the summer of 2006. One instructor has completed his BICSI level 2 certification, and the other instructor shall pursue his BICSI certification when the opportunity is presented.

Berkshire Community College and McCann Tech have developed an articulation agreement for the Cisco Academy. The agreement allows our students to receive college credit for Cisco Academy courses completed through the McCann IT program.

Seniors at McCann are also required to develop and present a senior project. Projects are submitted that have a degree of difficulty representative of the four years at McCann. Seniors will be provided with materials and one hundred hours of time to complete the project. Upon completion, the students are required to present their project to their peers, teachers, and community members. The senior project represents a large portion of their final grade.

## **Course Syllabus**

The senior student will be enrolled in the second half of the Cisco Networking Academy. During this year, the student will complete the last two of four modules: CCNA3 and CCNA4. CCNA3 focuses on the following advanced IP addressing techniques: Variable Length Subnet Masking (VLSM), intermediate routing protocols, CLI configuration of switches, Virtual LANs, and switch related protocols such as Spanning Tree Protocol, and VLAN Trunking Protocol.

CCNA 4 is the last course leading to the Cisco Certified Network Associate certification. The course focuses on the following topics: Advanced IP addressing techniques, Network and Port Address Translation, DHCP, WAN protocols, and network management techniques. After completing this course, students will take their certification exam for CCNA.

The IT Program uses the stringent assessment methods mandated by Cisco Systems. All assessment and projects are available on line and can be completed independently in a competency-based method. The course teaches the students to become competent self-learners.

Major projects for this year include two comprehensive case studies required for completion of CCNA3 and CCNA4. The case study for CCNA3 is used to illustrate the process and documentation required for a network design. This case study presents a scenario in which the XYZ Research Company has hired a Network Consultant Group to design their network. This case study requires that

you accomplish the following:

- Use the resources provided, diagram and narrative, to set up the physical network
- Set up an IP subnetting scheme using VLSM
- Configure the routers as required
- Set up and configure the switches and VLANs as required
- Verify and troubleshoot all connections
- Provide detailed documentation in the appropriate format
- Provide a written final report

The final case study allows students to build and configure a complex network using skills gained throughout the course. This case study is not a trivial task. To complete it as outlined with all required documentation will be a significant accomplishment. The following tasks are required to complete the case study:

- Set up the physical layout of the network using the diagram and accompanying narrative
- Correctly configure single-area OSPF
- Correctly configure VLANs and 802.1q trunking
- Correctly configure Frame Relay
- Correctly configure DHCP
- Correctly configure NAT
- Create and apply access control lists on the appropriate routers and interfaces
- Verify that all configurations are operational and functioning according to the scenario guidelines
- Provide detailed documentation.

## **CCNA3 Course Sequence**

### **Module 1. Introduction to Classless Routing**

#### 1.1 VLSM

1.1.1 What is VLSM and why is it used?

1.1.2 A waste of space

1.1.3 When to use VLSM?

1.1.4 Calculating subnets with VLSM

1.1.5 Route aggregation with VLSM

1.1.6 Configuring VLSM

#### 1.2 RIP Version 2

1.2.1 RIP history

1.2.2 RIP v2 features

1.2.3 Comparing RIP v1 and v2

1.2.4 Configuring RIP v2

1.2.5 Verifying RIP v2

1.2.6 Troubleshooting RIP v2

1.2.7 Default routes

### **Module 2. Single-Area OSPF**

#### 2.1 Link-State Routing Protocol

2.1.1 Overview of link-state routing

2.1.2 Link-state routing protocol features

2.1.3 How routing information is maintained

2.1.4 Link-state routing algorithms

2.1.5 Advantages and disadvantages of link-state routing

2.1.6 Compare and contrast distance vector and link-state routing

## 2.2 Single Area OSPF Concepts

- 2.2.1 OSPF overview
- 2.2.2 OSPF terminology
- 2.2.3 Comparing OSPF with distance vector routing protocols
- 2.2.4 Shortest path algorithm
- 2.2.5 OSPF network types
- 2.2.6 OSPF Hello protocol
- 2.2.7 Steps in the operation of OSPF
- 2.3 Single Area OSPF Configuration
  - 2.3.1 Configuring the OSPF routing process
  - 2.3.2 Configuring OSPF loopback address and router priority
  - 2.3.3 Modifying OSPF cost metric
  - 2.3.4 Configuring OSPF authentication
  - 2.3.5 Configuring OSPF timers
  - 2.3.6 OSPF, propagating a default route
  - 2.3.7 Common OSPF configuration issues
  - 2.3.8 Verifying the OSPF configuration

## **Module 3. EIGRP**

- 3.1 EIGRP Concepts
  - 3.1.1 Comparing EIGRP with IGRP
  - 3.1.2 EIGRP concepts and terminology
  - 3.1.3 EIGRP design features
  - 3.1.4 EIGRP technologies
  - 3.1.5 EIGRP data structures
  - 3.1.6 EIGRP algorithm
- 3.2 EIGRP Configuration
  - 3.2.1 Configuring EIGRP
  - 3.2.2 Configuring EIGRP summarization
  - 3.2.3 Verifying basic EIGRP
  - 3.2.4 Building neighbor tables
  - 3.2.5 Discover routes
  - 3.2.6 Select routes
  - 3.2.7 Maintaining routing tables
- 3.3 Troubleshooting Routing Protocols
  - 3.3.1 Routing protocol troubleshooting process
  - 3.3.2 Troubleshooting RIP configuration
  - 3.3.3 Troubleshooting IGRP configuration
  - 3.3.4 Troubleshooting EIGRP configuration
  - 3.3.5 Troubleshooting OSPF configuration

## **Module 4. Switching Concepts**

- 4.1 Introduction to Ethernet/802.3 LANs
  - 4.1.1 Ethernet/802.3 LAN development
  - 4.1.2 Factors that impact network performance
  - 4.1.3 Elements of Ethernet/802.3 networks
  - 4.1.4 Half-duplex networks
  - 4.1.5 Network congestion
  - 4.1.6 Network latency
  - 4.1.7 Ethernet 10BASE-T transmission time
  - 4.1.8 The benefits of using repeaters

- 4.1.9 Full-duplex transmitting
- 4.2 Introduction to LAN Switching
  - 4.2.1 LAN segmentation
  - 4.2.2 LAN segmentation with bridges
  - 4.2.3 LAN segmentation with routers
  - 4.2.4 LAN segmentation with switches
  - 4.2.5 Basic operations of a switch
  - 4.2.6 Ethernet switch latency
  - 4.2.7 Layer 2 and Layer 3 switching
  - 4.2.8 Symmetric and asymmetric switching
  - 4.2.9 Memory buffering
  - 4.2.10 Two switching methods
- 4.3 Switch Operation
  - 4.3.1 Functions of Ethernet switches
  - 4.3.2 Frame transmission modes
  - 4.3.3 How switches and bridges learn addresses
  - 4.3.4 How switches and bridges filter frames
  - 4.3.5 Why segment LANs?
  - 4.3.6 Microsegmentation implementation
  - 4.3.7 Switches and collision domains
  - 4.3.8 Switches and broadcast domains
  - 4.3.9 Communications between switches and workstations

## Module 5. Switches

- 5.1 LAN Design
  - 5.1.1 LAN design goals
  - 5.1.2 LAN design considerations
  - 5.1.3 LAN design methodology
  - 5.1.4 Layer 1 design
  - 5.1.5 Layer 2 design
  - 5.1.6 Layer 3 design
- 5.2 LAN Switches
  - 5.2.1 Switched LANs, access layer overview
  - 5.2.2 Access layer switches
  - 5.2.3 Distribution layer overview
  - 5.2.4 Distribution layer switches
  - 5.2.5 Core layer overview
  - 5.2.6 Core layer switches

## **Module 6. Switch Configuration**

- 6.1 Starting the Switch
  - 6.1.1 Physical startup of the Catalyst switch
  - 6.1.2 Switch LED indicators
  - 6.1.3 Verifying port LEDs during switch POST
  - 6.1.4 Viewing initial bootup output from the switch
  - 6.1.5 Examining keyboard help in the switch CLI
  - 6.1.6 Switch modes
- 6.2 Configuring the Switch
  - 6.2.1 Verifying the Catalyst switch default configuration
  - 6.2.2 Configuring the Catalyst switch
  - 6.2.3 Managing the MAC address table

- 6.2.4 Configuring static MAC addresses
- 6.2.5 Configuring port security
- 6.2.6 Executing adds, moves, and changes
- 6.2.7 Managing switch operating system
- 6.2.8 1900/2950 password recover
- 6.2.9 1900/2900 firmware upgrade

## **Module 7. Spanning Tree Protocol**

- 7.1 Redundant Topologies
  - 7.1.1 Redundancy
  - 7.1.2 Redundant topologies
  - 7.1.3 Redundant switched topologies
  - 7.1.4 Broadcast storms
  - 7.1.5 Multiple frame transmissions
  - 7.1.6 Media access control database instability
- 7.2 Spanning Tree Protocol
  - 7.2.1 Redundant topology and Spanning Tree
  - 7.2.2 Spanning Tree Protocol
  - 7.2.3 Spanning Tree operation
  - 7.2.4 Selecting a root bridge
  - 7.2.5 Stages of Spanning Tree port states
  - 7.2.6 Spanning Tree recalculation
  - 7.2.7 Rapid Spanning Tree Protocol

## **Module 8. Virtual LANs**

- 8.1 VLAN Concepts
  - 8.1.1 VLAN introduction
  - 8.1.2 Broadcast domains with VLANs and routers
  - 8.1.3 VLAN operation
  - 8.1.4 Benefits of VLANs
  - 8.1.5 VLAN types
- 8.2 VLAN Configuration
  - 8.2.1 VLAN basics
  - 8.2.2 Geographic VLANs
  - 8.2.3 Configuring static VLANs
  - 8.2.4 Verifying VLAN configuration
  - 8.2.5 Saving VLAN configuration
  - 8.2.6 Deleting VLANs
- 8.3 Troubleshooting VLANs
  - 8.3.1 Overview
  - 8.3.2 VLAN troubleshooting process
  - 8.3.3 Preventing broadcast storms
  - 8.3.4 Troubleshooting VLANs
  - 8.3.5 VLAN troubleshooting scenarios

## **Module 9. Virtual Trunking Protocol**

- 9.1 Trunking
  - 9.1.1 History of trunking
  - 9.1.2 Trunking concepts
  - 9.1.3 Trunking operation
  - 9.1.4 VLANs and trunking

- 9.1.5 Trunking implementation
- 9.2 VTP
  - 9.2.1 History of VTP
  - 9.2.2 VTP concepts
  - 9.2.3 VTP operation
  - 9.2.4 VTP implementation
  - 9.2.5 VTP configuration
- 9.3 Inter-VLAN Routing Overview
  - 9.3.1 VLAN basics
  - 9.3.2 Introducing inter-VLAN routing
  - 9.3.3 Inter-VLAN issues and solutions
  - 9.3.4 Physical and logical interfaces
  - 9.3.5 Dividing physical interfaces into subinterfaces
  - 9.3.6 Configuring inter-VLAN routing

## **Case Study: Switching Basics and Intermediate Routing**

### **CCNA4 Course Sequence**

#### **Module 1. Scaling IP Addresses**

- 1.1 Scaling Networks with NAT and PAT
  - 1.1.1 Private addressing
  - 1.1.2 Introducing NAT and PAT
  - 1.1.3 Major NAT and PAT features
  - 1.1.4 Configuring NAT and PAT
  - 1.1.5 Verifying PAT configuration
  - 1.1.6 Troubleshooting NAT and PAT configuration
  - 1.1.7 Issues with NAT
- 1.2 DHCP
  - 1.2.1 Introducing DHCP
  - 1.2.2 BOOTP and DHCP differences
  - 1.2.3 Major DHCP features
  - 1.2.4 DHCP operation
  - 1.2.5 Configuring DHCP
  - 1.2.6 Verifying DHCP operation
  - 1.2.7 Troubleshooting DHCP
  - 1.2.8 DHCP relay

#### **Module 2. WAN Technologies**

- 2.1 WAN Technologies Overview
  - 2.1.1 WAN technology
  - 2.1.2 WAN devices
  - 2.1.3 WAN standards
  - 2.1.4 WAN encapsulation
  - 2.1.5 Packet and circuit switching
  - 2.1.6 WAN link options
- 2.2 WAN Technologies
  - 2.2.1 Analog dialup
  - 2.2.2 ISDN
  - 2.2.3 Leased line
  - 2.2.4 X.25
  - 2.2.5 Frame Relay

- 2.2.6 ATM
- 2.2.7 DSL
- 2.2.8 Cable modem
- 2.3 WAN Design
  - 2.3.1 WAN communication
  - 2.3.2 Steps in WAN design
  - 2.3.3 How to identify and select networking capabilities
  - 2.3.4 Three-layer design model
  - 2.3.5 Other layered design models
  - 2.3.6 Other WAN design considerations

### **Module 3. PPP**

- 3.1 Serial Point-to-Point Links
  - 3.1.1 Introduction to serial communication
  - 3.1.2 Time-division multiplexing
  - 3.1.3 Demarcation point
  - 3.1.4 DTE-DCE
  - 3.1.5 HDLC encapsulation
  - 3.1.6 Configuring HDLC encapsulation
  - 3.1.7 Troubleshooting a serial interface
- 3.2 PPP Authentication
  - 3.2.1 PPP layered architecture
  - 3.2.2 Establishing a PPP session
  - 3.2.3 PPP authentication protocols
  - 3.2.4 Password Authentication Protocol (PAP)
  - 3.2.5 Challenge Handshake Authentication Protocol
  - 3.2.6 PPP encapsulation and authentication process
- 3.3 Configuring PPP
  - 3.3.1 Introduction to configuring PPP
  - 3.3.2 Configuring PPP
  - 3.3.3 Configuring PPP authentication
  - 3.3.4 Verifying the serial PPP encapsulation configuration
  - 3.3.5 Troubleshooting the serial PPP encapsulation configuration

### **Module 4. ISDN and DDR**

- 4.1 ISDN Concepts
  - 4.1.1 Introducing ISDN
  - 4.1.2 ISDN standards and access methods
  - 4.1.3 ISDN 3-layer model and protocols
  - 4.1.4 ISDN functions
  - 4.1.5 ISDN reference points
  - 4.1.6 Determining the router ISDN interface
  - 4.1.7 ISDN switch types
- 4.2 ISDN Configuration
  - 4.2.1 Configuring ISDN BRI
  - 4.2.2 Configuring ISDN PRI
  - 4.2.3 Verifying ISDN configuration
  - 4.2.4 Troubleshooting the ISDN configuration
- 4.3 DDR Configuration
  - 4.3.1 DDR operation
  - 4.3.2 Configuring legacy DDR

- 4.3.3 Defining static routes for DDR
- 4.3.4 Specifying interesting traffic for DDR
- 4.3.5 Configuring DDR dialer information
- 4.3.6 Dialer profiles
- 4.3.7 Configuring dialer profiles
- 4.3.8 Verifying DDR configuration
- 4.3.9 Troubleshooting the DDR configuration

## **Module 5. Frame Relay**

- 5.1 Frame Relay Concepts
  - 5.1.1 Introducing Frame Relay
  - 5.1.2 Frame Relay terminology
  - 5.1.3 Frame Relay stack layered support
  - 5.1.4 Frame Relay bandwidth and flow control
  - 5.1.5 Frame Relay address mapping/topology
  - 5.1.6 Frame Relay LMI
  - 5.1.7 Stages of Inverse ARP and LMI operation
- 5.2 Configuring Frame Relay
  - 5.2.1 Configuring basic Frame Relay
  - 5.2.2 Configuring a static Frame Relay map
  - 5.2.3 Reachability issues with routing updates in NBMA
  - 5.2.4 Frame Relay subinterfaces
  - 5.2.5 Configuring Frame Relay subinterfaces
  - 5.2.6 Verifying the Frame Relay configuration
  - 5.2.7 Troubleshooting the Frame Relay configuration

## **Module 6. Introduction to Network Administration**

- 6.1 Workstations and Servers
  - 6.1.1 Workstations
  - 6.1.2 Servers
  - 6.1.3 Client-server relationship
  - 6.1.4 Introduction to NOS
  - 6.1.5 Microsoft NT, 2000, and .NET
  - 6.1.6 UNIX Sun, HP, and LINUX versions
  - 6.1.7 Apple
  - 6.1.8 Concept of service on servers
- 6.2 Network Management
  - 6.2.1 Introduction to network management
  - 6.2.2 OSI and network management model
  - 6.2.3 SNMP and CMIP standards
  - 6.2.4 SNMP operation
  - 6.2.5 Structure of management information and MIBs
  - 6.2.6 SNMP protocol
  - 6.2.7 Configuring SNMP
  - 6.2.8 RMON
  - 6.2.9 Syslog

## **Case Study: WANs**

## **Embedded VTE Frameworks**

## **2.N Describe user support services**

- 2.N.1 Describe ways to orient user to network policies and operations
- 2.N.2 Identify user support needed for a variety of situations
- 2.N.3 Describe how to respond professionally to user requests
- 2.N.4 Explain how to prioritize and manage multiple customer requests
- 2.N.5 Illustrate methods used to communicate and document technical support provided
- 2.N.6 Create a customer needs assessment
- 2.N.7 Analyze methods of providing technical support for a variety of problems
- 2.N.8 Identify means to communicate with customer within support boundaries
- 2.N.9 Plan and perform custom training

## **2.O Identify network design concepts**

- 2.O.1 Identify professional outsourcing needed to realize design
- 2.O.2 Identify power consumption requirements
- 2.O.3 Define NEMA (electrical) standards
- 2.O.4 Identify the importance of a UPS
- 2.O.5 Demonstrate procedure for a disaster recovery of a catastrophic failure
- 2.O.6 Identify physical requirements for network implementation
- 2.O.7 Identify the standards of efficiency and effectiveness (uniformity) for the design
- 2.O.8 Identify system requirements for network implementation including specialized servers
- 2.O.9 Identify application requirements for network implementation
- 2.O.10 Identify environmental factors on computer networks

## **2.P Use TCP/IP to establish connectivity**

- 2.P.1 Describe name resolution technologies and methods
- 2.P.2 Define DHCP, DNS, WINS and host files
- 2.P.3 Summarize TCP/IP addressing
- 2.P.4 Test, validate, and troubleshoot IP connectivity using TCP/IP utilities
- 2.P.5 Describe various telecom considerations and processes including convergence, and Voice Over IP

## **2.Q Maintain, monitor and troubleshoot network performance**

- 2.Q.1 Perform software upgrades and fixes
- 2.Q.2 Perform standard server backup procedures
- 2.Q.3 Perform standard server restoration from backup
- 2.Q.4 Maintain accurate network documentation
- 2.Q.5 Monitor system status and performance
- 2.Q.6 Identify abnormal system performance
- 2.Q.7 Recognize system alerts
- 2.Q.8 Monitor system log files
- 2.Q.9 Recognize security problems
- 2.Q.10 Recognize environmental problems
- 2.Q.11 Analyze how server usage effects network performance (web server, file server, print server, etc)
- 2.Q.12 Establish network documentation of inventory and assets
- 2.Q.13 Identify various security, video, building utility monitoring systems and how they link to the network
- 2.Q.14 Demonstrate ability to monitor performance from PC to hubs to server
- 2.Q.15 Identify basic troubleshooting steps
- 2.Q.16 Identify problems using diagnostic tools when appropriate
- 2.Q.17 Identify and test solutions

2.Q.18 Document results and solution

2.Q.19 Identify the need for and use appropriately, network troubleshooting tools such as ping, nslookup, telnet, and tracert

## **2.R Install and configure infrastructure components**

2.R.1 Configure a NIC

2.R.2 Identify major operating systems: UNIX, LINUX, Microsoft, Novell

2.R.3 Install server software

2.R.4 Configure server software for network access

2.R.5 Compare and contrast file level security and domain or directory services

2.R.6 Create shared user resources

2.R.7 Differentiate between a switch and a router

2.R.8 Identify hardware needed to connect switch/router to a network

2.R.9 Describe the use of functions of a switch/router

2.R.10 Demonstrate procedures used to communicate with a switch/router

2.R.11 Demonstrate procedures used to configure a switch/router

2.R.12 Demonstrate procedures used to install a switch/router

## **2.S Install and configure network applications**

2.S.1 Install and configure Internet browser software packages

2.S.2 Install and configure network-based application

2.S.3 Configure network resources at the client level (mapped drives, printers, folders, etc)

## **2.T Administrate and secure a network**

2.T.1 Demonstrate how to establish and maintain user accounts, rights, and permissions

2.T.2 Explain the use of scripts in customizing user environments

2.T.3 Document and manage patch panels and connections

2.T.4 Distinguish between user level and share level server models

2.T.5 Describe good practices of password procedures

2.T.6 Illustrate concepts of data encryption and its use with protecting network resources

2.T.7 Describe firewall uses

2.T.8 Implement and maintain system wide virus protection software

2.T.9 Identify uses for VPN and network data encryption

## **2.Z Determine wattage requirements of a system and test voltages with a multi-meter**

2.Z.1 List different case characteristics

2.Z.2 List different power supply properties and characteristics

2.Z.3 Test voltages employing proper load requirements using a digital multimeter

2.Z.4 Determine wattage requirements of a system

## **2.CC Perform preventive maintenance procedures**

2.CC.1 Identify the purpose of various types of preventive maintenance products and procedures

2.CC.2 Schedule and perform preventive procedures including hard drive maintenance utilities.

2.CC.3 Describe the need for and implementation of surge protection

## **2.EE Troubleshoot hardware problems**

2.EE.1 Identify stages of the troubleshooting process

2.EE.2 Differentiate between normal and abnormal operations

2.EE.7 Describe common faults in adapter interface cards

2.EE.11 Solve common hardware problems after they have been identified

# Strand 3: Embedded Academics from the Massachusetts Curriculum Frameworks

## Course: CCNA 3

### Chapter 1 - Introduction to Classless Routing

#### Objective 1.1 - VLSM

##### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

##### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive real numbers for any positive integer  $n$ ; and the inverse relationship between taking the  $n$ th root of and the  $n$ th power of a positive real number.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive
- MA10.P.1 - Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonacci Numbers), linear, quadratic, and exponential functional relationships.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.
- MA12.N.1 - Define complex numbers (e.g.,  $a + bi$ ) and operations on them, in particular, addition, subtraction, multiplication, and division. Relate the system of complex numbers to the systems of real and rational numbers.
- MA12.N.2 - Simplify numerical expressions with powers and roots, including fractional and negative exponents.

- MA12.P.2 - Identify arithmetic and geometric sequences and finite arithmetic and geometric series. Use the properties of such sequences and series to solve problems, including finding the general term and sum recursively and explicitly.

### **Objective 1.2 - RIP Version 2**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

### **Chapter 2 - Single Area OSPF**

#### **Objective 2.1 - Link-State Routing Protocol**

##### Language Arts

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### **Objective 2.2 - Single Area OSPF Concepts**

##### Language Arts

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### **Objective 2.3 - Single Area OSPF Configuration**

##### Language Arts

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

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### **Chapter 3 - EIGRP**

### **Objective 3.1 - EIGRP Concepts**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive real numbers for any positive integer  $n$ ; and the inverse relationship between taking the  $n$ th root of and the  $n$ th power of a positive real number.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 3.2 - EIGRP Configuration**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive real numbers for any positive integer  $n$ ; and the inverse relationship between taking the  $n$ th root of and the  $n$ th power of a positive real number.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 3.3 - Troubleshooting Routing Protocols**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive real numbers for any positive integer  $n$ ; and the inverse relationship between taking the  $n$ th root of and the  $n$ th power of a positive real number.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Chapter 4 - Switching Concepts**

#### **Objective 4.1 - Introduction to Ethernet/802.3 LANs**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.

- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 4.2 - Introduction to LAN Switching**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 4.3 - Switch Operation**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line

graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

## **Chapter 5 - Switches**

### **Objective 5.1 - LAN Design**

#### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.G.10 - Demonstrate the ability to visualize solid object and recognize their projections and cross sections.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 5.2 - LAN Switches**

#### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising

them.

- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.G.10 - Demonstrate the ability to visualize solid object and recognize their projections and cross sections.
- MA10.G.10 - Demonstrate the ability to visualize solid object and recognize their projections and cross sections.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

#### Science

- ENG 6 - COMMUNICATION TECHNOLOGIES Broad Concept: The application of technical processes to exchange information includes symbols, measurements, icons, and graphic images.
- ENG 6 - COMMUNICATION TECHNOLOGIES Broad Concept: The application of technical processes to exchange information includes symbols, measurements, icons, and graphic images.
- ENG 6.4 - Explain the components of a communication system, i.e., source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.
- ENG 6.4 - Explain the components of a communication system, i.e., source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.

### **Chapter 6 - Switch Configuration**

#### **Objective 6.1 - Starting the Switch**

##### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.
- 8 - Students will identify the basic facts and main ideas in a text and use them as the basis for interpretation.

## Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 6.2 - Configuring the Switch**

#### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.
- 8 - Students will identify the basic facts and main ideas in a text and use them as the basis for interpretation.

## Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Chapter 7 - Spanning-Tree Protocol**

#### **Objective 7.1 - Redundant Topologies**

#### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the

- quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive real numbers for any positive integer  $n$ ; and the inverse relationship between taking the  $n$ th root of and the  $n$ th power of a positive real number.
- MA10.N.1 - Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of  $n$ th roots of positive
- MA12.N.2 - Simplify numerical expressions with powers and roots, including fractional and negative exponents.
- MA12.P.2 - Identify arithmetic and geometric sequences and finite arithmetic and geometric series. Use the properties of such sequences and series to solve problems, including finding the general term and sum recursively and explicitly.

#### **Objective 7.2 - Spanning-Tree Protocol**

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.

#### **Chapter 8 - Virtual LANs**

#### **Objective 8.1 - VLAN Concepts**

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line

graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

#### Objective 8.2 - VLAN Configuration

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.

##### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

#### Objective 8.3 - Troubleshooting VLAN s

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.

##### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Chapter 9 - Virtual Trunking Protocol**

#### **Objective 9.3 - Inter-VLAN Routing Overview**

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Course: CCNA 4**

#### **Chapter 1 - Scaling IP Addresses**

##### **Objective 1.2 - DHCP**

#### Language Arts

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### **Chapter 2 - WAN Technologies**

##### **Objective 2.1 - WAN Technologies Overview**

#### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line

graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

- MA10.M.4 - Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.
- MA12.P.2 - Identify arithmetic and geometric sequences and finite arithmetic and geometric series. Use the properties of such sequences and series to solve problems, including finding the general term and sum recursively and explicitly.

### **Objective 2.2 - WAN Technologies**

#### Language Arts

- 13 - Students will identify, analyze, and apply knowledge of the purposes, structure, and elements of nonfiction or informational materials and provide evidence from the text to support their understanding.
- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 23 - Students will organize ideas in writing in a way that makes sense for their purpose.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.M.4 - Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.
- MA12.P.2 - Identify arithmetic and geometric sequences and finite arithmetic and geometric series. Use the properties of such sequences and series to solve problems, including finding the general term and sum recursively and explicitly.

### **Objective 2.3 - WAN Design**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.

- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.N.4 - Use estimation to judge the reasonableness of results of computations and of solutions to problems involving real numbers.
- MA10.N.4 - Use estimation to judge the reasonableness of results of computations and of solutions to problems involving real numbers.
- MA10.P.1 - Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonacci Numbers), linear, quadratic, and exponential functional relationships.
- MA10.P.6 - Solve equations and inequalities including those involving absolute value of linear expressions (e.g.,  $|1x - 2| > 5$ ) and apply to the solution of problems.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.
- MA12.P.2 - Identify arithmetic and geometric sequences and finite arithmetic and geometric series. Use the properties of such sequences and series to solve problems, including finding the general term and sum recursively and explicitly.

#### Science

- Earth 1.3 - Describe the characteristics of waves (wavelength, frequency, velocity, amplitude).
- Earth 1.3 - Describe the characteristics of waves (wavelength, frequency, velocity, amplitude).
- ENG 5 - ENERGY AND POWER TECHNOLOGIES – ELECTRICAL SYSTEMS Broad Concept: Electrical systems generate, transfer, and distribute electricity.
- ENG 5 - ENERGY AND POWER TECHNOLOGIES – ELECTRICAL SYSTEMS Broad Concept: Electrical systems generate, transfer, and distribute electricity.
- ENG 5.1 - Describe the different instruments that can be used to measure voltage, e.g., voltmeter, multimeter.
- ENG 5.1 - Describe the different instruments that can be used to measure voltage, e.g., voltmeter, multimeter.
- ENG 5.2 - Identify and explain the components of a circuit including a source, conductor, load, and controllers (controllers are switches, relays, diodes, transistors, integrated circuits).
- ENG 5.2 - Identify and explain the components of a circuit including a source, conductor, load, and controllers (controllers are switches, relays, diodes, transistors, integrated circuits).
- ENG 5.3 - Explain the relationship between resistance, voltage, and current (Ohm's Law).
- ENG 5.3 - Explain the relationship between resistance, voltage, and current (Ohm's Law).
- ENG 5.4 - Determine the voltages and currents in a series circuit and a parallel circuit.

- ENG 5.4 - Determine the voltages and currents in a series circuit and a parallel circuit.
- ENG 5.5 - Explain how to measure voltage, resistance, and current in electrical systems.
- ENG 5.5 - Explain how to measure voltage, resistance, and current in electrical systems.
- ENG 5.6 - Explain how to measure voltage, resistance, and current in electrical systems.
- ENG 5.6 - Explain how to measure voltage, resistance, and current in electrical systems.
- Phy 1 - MOTION AND FORCE Broad Concept: Newton's laws of motion and gravitation describe and predict the motion of most objects.
- Phy 1 - MOTION AND FORCE Broad Concept: Newton's laws of motion and gravitation describe and predict the motion of most objects.
- Phy 1.1 - Distinguish between vector quantities (velocity, acceleration, and force) and scalar quantities (speed and mass).
- Phy 1.1 - Distinguish between vector quantities (velocity, acceleration, and force) and scalar quantities (speed and mass).
- Phy 4 - WAVES Broad Concept: Waves carry energy from place to place without the transfer of matter.
- Phy 4 - WAVES Broad Concept: Waves carry energy from place to place without the transfer of matter.
- Phy 4.2 - Recognize the measurable properties of waves (e.g., velocity, frequency, wavelength) and explain the relationships among them.
- Phy 4.2 - Recognize the measurable properties of waves (e.g., velocity, frequency, wavelength) and explain the relationships among them.
- Phy 4.7 - Explain, graph, and interpret graphs of constructive and destructive interference of waves.
- Phy 4.7 - Explain, graph, and interpret graphs of constructive and destructive interference of waves.
- Phy 4.8 - Explain the relationship between the speed of a wave (e.g., sound) and the medium it travels through.
- Phy 4.8 - Explain the relationship between the speed of a wave (e.g., sound) and the medium it travels through.
- Phy 5 - ELECTROMAGNETISM Broad Concept: Stationary and moving charge particles result in the phenomenon known as electricity and magnetism.
- Phy 5 - ELECTROMAGNETISM Broad Concept: Stationary and moving charge particles result in the phenomenon known as electricity and magnetism.
- Phy 5.1 - Recognize the characteristics of static charge, and explain how a static charge is generated.
- Phy 5.1 - Recognize the characteristics of static charge, and explain how a static charge is generated.
- Phy 5.2 - Interpret and apply Coulomb's law.
- Phy 5.2 - Interpret and apply Coulomb's law.
- Phy 5.3 - Explain the difference in concept between electric forces and electric fields.
- Phy 5.3 - Explain the difference in concept between electric forces and electric fields.
- Phy 5.4 - Develop a qualitative and quantitative understanding of current, voltage, resistance, and the connection between them.
- Phy 5.5 - Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.
- Phy 5.5 - Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.
- Phy 5.6 - Analyze circuits (find the current at any point and the potential difference between any two points in the circuit) using Kirchoff's and Ohm's laws.
- Phy 5.6 - Analyze circuits (find the current at any point and the potential difference between any two points in the circuit) using Kirchoff's and Ohm's laws.

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## **Chapter 3 - PPP**

### **Objective 3.1 - Serial Point-to-Point Links**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 3.2 - PPP Authentication**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 3.3 - Configuring PPP**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.

- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Chapter 4 - ISDN and DDR**

#### **Objective 4.1 - ISDN Concepts**

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range)
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

#### **Objective 4.2 - ISDN Configuration**

##### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

##### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean,

median, range

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

### **Objective 4.3 - DDR Configuration**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

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### **Chapter 5 - Frame Relay**

#### **Objective 5.1 - Frame Relay Concepts**

#### Language Arts

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

## **Objective 5.2 - Configuring Frame Relay**

### Language Arts

- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.
- 

## **Chapter 6 - Introduction to Network Administration**

### **Objective 6.1 - Workstations and Servers**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 2 - Students will pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions or interviews in order to acquire new knowledge.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range
- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.G.10 - Demonstrate the ability to visualize solid object and recognize their projections and cross sections.
- MA10.N.4 - Use estimation to judge the reasonableness of results of computations and of

- solutions to problems involving real numbers.
- MA10.P.1 - Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonacci Numbers), linear, quadratic, and exponential functional relationships.
- MA10.P.6 - Solve equations and inequalities including those involving absolute value of linear expressions (e.g.,  $|x - 2| > 5$ ) and apply to the solution of problems.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Objective 6.2 - Network Management**

#### Language Arts

- 19 - Students will write with a clear focus, coherent organization, and sufficient detail.
- 21 - Students will demonstrate improvement in organization, content, paragraph development, level of detail, style, tone, and word choice (diction) in their compositions after revising them.
- 24 - Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- 4 - Students will understand and acquire new vocabulary and use it correctly in reading and writing.

#### Math

- MA10.D.1 - Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- MA10.P.1 - Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonacci Numbers), linear, quadratic, and exponential functional relationships.
- MA10.P.6 - Solve equations and inequalities including those involving absolute value of linear expressions (e.g.,  $|x - 2| > 5$ ) and apply to the solution of problems.
- MA12.D.2 - Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.

### **Strand 4: Employability**

Competencies in strand 4 are fulfilled by the Skills USA PDP curriculum.

### **Strand 5: Management and Entrepreneurship**

Competencies in strand 5 are fulfilled by the academic courses Personal Finance and Business Management.

### **Strand 6: Underlying Principles of Technology**

- 6.A Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity
- 6.A.1 a Select and utilize the appropriate technology to solve a problem or complete a task
- 6.A.2 a Demonstrate file management skills (e.g., install new software, compress and expand files as needed, download files as appropriate)
- 6.A.3 a Differentiate between different operating systems and demonstrate use of at least one to open and switch between programs and files

- 6.A.4 a Identify and demonstrate resolutions to simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems)
- 6.A.5 a Save, retrieve, load, format, and import data into, and export a variety of electronic documents (word processing, spreadsheet, database, AND desktop publishing)
- 6.A.6 a Demonstrate the proper use of a variety of external peripherals and how they connect to a computer
- 6.A.7 a Illustrate methods of selecting and using search engines
- 6.A.8 a Send, receive, and manage electronic correspondence and files, in accordance with school policy
- 6.A.9 a Demonstrate proper use of electronic proofreading tools and explain reasons why these shouldn't be relied upon solely
- 6.B Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media
  - 6.B.1 a Identify ways in which technology is used in the workplace and in society
  - 6.B.2 a Summarize the rights and responsibilities of the school's Acceptable Use Policy
  - 6.B.3 a Explain laws restricting use of copyrighted materials on the Internet
  - 6.B.4 a Discuss the concerns about electronic communications, privacy and security, including protection from spyware and viruses.
- 6.C Demonstrate ability to use technology for research, problem solving, and communication
  - 6.C.1 a Locate, evaluate, collect, and process information from a variety of electronic sources
  - 6.C.2 a Demonstrate the use of telecommunications and other media to interact or collaborate with peers, experts, and other audiences
  - 6.C.3 a Demonstrate the use of appropriate electronic sources to conduct research (e.g., Web sites, online periodical databases, and on line catalogs)
  - 6.C.4 a Demonstrate proper style (with correct citations) when integrating electronic research results into a research project
  - 6.C.5 a Collect, organize, analyze, and graphically present data using the most appropriate tools
  - 6.C.6 a Present information, ideas, and results of work using any of a variety of communications technologies (e.g., multimedia presentations, Web pages, videotapes, desktop-published documents)
  - 6.C.7 a Identify capabilities of technology resources and describe how they can be used for lifelong learning
  - 6.C.8 a Demonstrate the proper use of electronic tools and office communications equipment (telephone, fax, copier, etc)
- 6.D Manage files
  - 6.D.1 c Explain directory structure
  - 6.D.2 c Navigate directory structure to find a specific file/folder
  - 6.D.3 c Explain and apply procedures used to manipulate folders
  - 6.D.4 c Explain and apply procedures used to manipulate files
  - 6.D.5 c Explain and apply procedures used to compress and uncompress files
  - 6.D.6 c Explain and apply procedures used to associate file types with appropriate programs
  - 6.D.7 c Differentiate between local and network drives, Internet and intranet files
- 6.E Use and relate common interfaces and applications
  - 6.E.1 c Identify common user interface properties
  - 6.E.2 c Identify common application components, such as help, file, view, tools, options
  - 6.E.3 c Select source and destination applications
  - 6.E.4 c Move/copy information between integrated applications
  - 6.E.5 c Demonstrate how to link an object between applications

- 6.E.6 c Embed information between applications
  
- 6.F Use word processing software
  - 6.F.1 c Demonstrate keyboarding skills
  - 6.F.2 c Explain and apply methods of formatting text
  - 6.F.3 c Demonstrate commands used to find and replace text
  - 6.F.4 c Demonstrate the use of spell check, grammar checker, and thesaurus
  - 6.F.5 c Demonstrate ability to create and use tables
  - 6.F.6 c Demonstrate use of headers and footers
  - 6.F.7 c Demonstrate ways to insert hyperlinks, clip art, and pictures into documents
  
  - 6.F.8 c Demonstrate the proper way to use printing materials and functions
  - 6.F.9 c Demonstrate the use of help functions
  - 6.F.10 c Demonstrate how to merge documents
  
- 6.G Create and use spreadsheets
  - 6.G.1 c Demonstrate how to create, edit, and save a spreadsheet
  - 6.G.2 c Demonstrate procedures used to open files, enter labels, enter values, and print worksheets
  - 6.G.3 c Explain and apply formulas and functions to a spreadsheet
  - 6.G.4 c Explain and apply "if" functions in a spreadsheet
  - 6.G.5 c Demonstrate how to format and manipulate cells, rows and columns
  - 6.G.6 c Demonstrate how to create charts and graphs
  - 6.G.7 c Demonstrate the use of help functions
  
- 6.H Create and use databases
  - 6.H.1 c Demonstrate how to create a simple database
  - 6.H.2 c Demonstrate how to modify database structure
  - 6.H.3 c Demonstrate how to enter and edit data through data sheet/list view
  - 6.H.4 c Demonstrate how to enter and edit data through form view
  - 6.H.5 c Demonstrate techniques used to search/query database to locate specific information
  - 6.H.6 c Demonstrate how to create reports from a database
  - 6.H.7 c Demonstrate the use of help functions
  
- 6.I Explain the various types of relationships between data in a database
  - 6.I.1 c Identify use of a simple relational database
  - 6.I.2 c Plan, design and create a simple relational database
  
- 6.J Create presentations using software application
  - 6.J.1 c Demonstrate how to create, edit, and deliver a simple slide presentation
  - 6.J.2 c Explain considerations with and insert multimedia elements into a slide
  - 6.J.3 c Enhance presentations using animation and transitions
  - 6.J.4 c Demonstrate how slide shows can be run manually and automatically
  - 6.J.5 c Identify and print formats using single slides, entire presentation, outlines and notes
  - 6.J.6 c Demonstrate the use of help functions
  
- 6.K Explain underlying concepts of and effectively use the Internet
  - 6.K.1 c Identify components of the Internet
  - 6.K.2 c Identify components incorporated in a web site
  - 6.K.3 c Identify the components of an Internet address (URL)
  - 6.K.4 c Describe the function of search engines
  - 6.K.5 c Demonstrate strategies to locate and retrieve electronic information

- 6.K.6 c Create and organize bookmarks in a browser
- 6.K.7 c Explain laws relating to copyright and Internet use
- 6.K.8 c Evaluate electronic sources of information for authenticity
- 6.K.9 c Properly document and cite electronic sources of information
- 6.K.10 c Discuss the concerns regarding electronic communication and privacy
- 6.K.11 c Define E-Mail protocol and uses
- 6.K.12 c Define Instant Messaging protocol and uses
- 6.L Protect a computer against viruses
- 6.L.1 c Define the various virus types and their potential effects
- 6.L.2 c Perform anti virus procedures, including installing, updating and scanning
- 6.L.3 c Identify potential sources of virus infection
- 6.L.4 c Identify basic security risks to system and personal computing equipment
- 6.L.5 c Explain the benefits and demonstrate the use of privacy, password, and protection utilities

## **Senior Project Standards Addressed**

VTE Curriculum Frameworks Standardized Objectives, Strands 4, 5 & 6

### Strand 4: Employability

- 4.B Communicate in multiple modes to address needs within the career and technical field
- 4.C Solve problems using critical thinking
- 4.D Demonstrate positive work behaviors

### Strand 5: Management and Entrepreneurship

- 5.A Analyze basic business practices required to start and run a company/organization
- 5.B Manage all resources related to a business/organization
- 5.C Describe methods for managing, organizing, retrieving and reporting financial data

### Strand 6: Underlying Principles of Technology

- 6.A Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity
- 6.B Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media
- 6.C Demonstrate ability to use technology for research, problem solving, and communication

## **Validated Competency Listing**

We are in alignment with the Massachusetts VTE frameworks, and all competencies have been validated by our program advisory board.

## **Competency Reporting System**

Competencies are maintained locally and on the Cisco servers. The grades from the Cisco Academy are transposed to McCann based on the policy established in Student/Parent Handbook:

“Report cards are issued quarterly and serve as a guideline for students and their parents to measure achievement. Parents are encouraged to contact teachers and counselors to ensure a continuing participation in student progress. Courses are graded numerically in accordance with the following values.”

80-89	Proficient
70-79	Satisfactory
65-69	Passing
0-64	Failing

Theory (30%)		Performance (70%)	
20%	Homework	75%	Competency/Performance
15%	Notebook	10%	Attendance/Participation
40%	Tests/quizzes	15%	Skills USA Project
10%	Attendance/Participation		

Student competencies are recorded using these performance indicators:

0	No competency
1	Below average
2	Average
3	Above average
4	Exemplary

In determining the degree of competency, the students are graded by rubric in the following areas:

- Work quality: The degree of excellence in which the activity was completed.
- Knowledge of project theory: The amount of knowledge demonstrated by the student. Determined by student-teacher interaction.
- Neatness of work: The degree of cleanliness and orderliness of the final project and during the process of assembly.
- Participation: The amount of effort put forth by the student.
- Independent work: The amount of work performed by the student without the need for *additional* instructor assistance.
- Timeliness: The degree to which the work was performed in a feasible amount of time.

### **Instructional Activities**

The curriculum is project-based with the projects designed around real world scenarios. In addition to assigned project work, students provide support assistance for the network and computers within the school. Related student work at off site non-profit organizations has provided excellent training in the past and future opportunities are always sought after. The IT department fully participates in the Skills USA program. We have successfully competed in the internetworking, computer maintenance technology, and web design competitions. The Skills USA competitions are a major motivating factor for student learning.

## **Resources**

Textbook: CCNA1 and 2 Companion Guide, revised 3<sup>rd</sup> Edition, Copyright 2005 by Cisco Press

Textbook: CCNA3 and 4 Companion Guide, 3<sup>rd</sup> Edition, Copyright 2003 by Cisco Press

Lab Manual: CCNA1 and 2 Lab Companion, Revised 3<sup>rd</sup> Edition, Copyright 2005 by Cisco Press

Lab Manual: CCNA3 and 4 Lab Companion, 3<sup>rd</sup> Edition, Copyright 2003 by Cisco Press

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