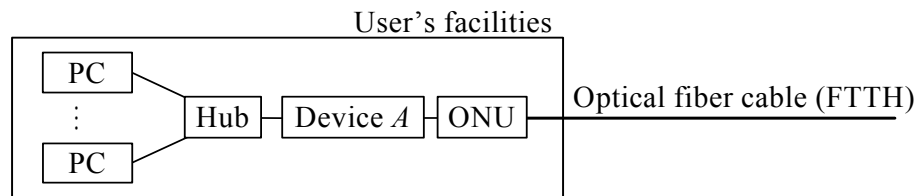


Q30. Multiple PCs are connected to the Internet with FTTH. The WAN interface of device *A* has a single global IP address allocated to it. Which of the following is the function of device *A* that enables these PCs to connect to the Internet by sharing the global IP address?



- a) DHCP
- b) NAT (IP masquerade)
- c) Packet filtering
- d) PPPoE

Q33. In IPv4, what is the maximum number of IP addresses that can be assigned to hosts in the network of 172.16.64.0/23? Here, the decimal number after the slash (/) is the number of bits used for the network prefix.

- a) 254 b) 256 c) 510 d) 512

Q34. Which of the following is the broadcast address of the network with the address 192.168.128.0/26? Here, the decimal number after the slash (/) is the number of bits used for the network prefix.

- a) 192.168.128.63
- c) 192.168.128.252

- b) 192.168.128.127
- d) 192.168.128.255

Q35. Which of the following is an Internet standard that is used to convert IP addresses to the corresponding MAC addresses?

- a) ARP
- b) ICMP
- c) RARP
- d) RIP

Q30. In the OSI basic reference model, which of the following is a network device that operates at the network layer?

- a) Access point b) Bridge c) Repeater d) Router

Q31. Which of the following is a mechanism that enables multiple terminals to have private addresses different from each other to connect to the Internet by sharing a single global IP address?

- a) DHCP b) DNS c) NAT d) RADIUS

Q32. Which of the following is a data link layer function that enables a receiver to control the amount of data a sender transmits?

- a) Congestion control
- b) Error control
- c) Flow control
- d) Media access control

Q33. In TCP/IP, which of the following is an application layer protocol that enables a server to automatically configure its clients with network information such as IP addresses, the subnet mask, and the default gateway address?

- a) ARP
- b) DHCP
- c) DNS
- d) NSLOOKUP

Q34. Which of the following is an appropriate explanation of Software-Defined Networking (SDN) that uses OpenFlow?

- a) It is a network technology that logically separates data forwarding and network control, and it is implemented with a combination of network devices specialized for data forwarding function, and a network control software.
- b) It is a software technology for business operation analysis and visualization that uses data flow diagrams and activity diagrams to discover problems in business processes and make improvements.
- c) It is an Internet of Things (IoT) technology that uses RFID, and it is a software architecture that optimizes distribution networks.
- d) It is an optimum deployment method for servers on a network that was developed to efficiently stream a range of content over the Internet.

Q35. Which of the following is an appropriate description of a Trojan horse?

- a) A brute force attack software tool
- b) A malicious computer program that presents itself as a legitimate one
- c) A malicious user that steals private information from a system
- d) A software tool to decrypt an encrypted password

Q31. Which of the following is an appropriate transmission operation of a node connected to a CSMA/CD LAN?

- a) All nodes are connected in a ring topology, where a special frame is circulated around to control transmission rights. Only the node that has the special frame can transmit data.
- b) Each node is logically ordered, a transmission right is passed along in order, and only the node that has received the right can transmit data.
- c) Each node waits for the medium to be idle before transmitting data. When collision occurs, it waits for a random backoff time before retransmission.
- d) Only the node that has a time slot assigned can transmit data.

Q32. In a TCP/IP environment, which of the following is a protocol for synchronizing the clocks of multiple computers with that of a time server?

a) FTP

b) NNTP

c) NTP

d) RTP

Q33. Which of the following is an appropriate explanation of DHCP?

- a) It is a protocol for accessing a directory service.
- b) It is a protocol for automatically assigning an IP address.
- c) It is a protocol for converting a private IP address to a global IP address.
- d) It is a protocol for forwarding an e-mail.

Q32. Which of the following is a role played by a DNS in a TCP/IP network?

- a) It assigns an unused IP address from the pool of addresses in response to a request from a PC or a printer.
- b) It associates domain or host names with IP addresses.
- c) It converts private IP addresses used within a company into global IP addresses, and it enables access to the Internet.
- d) It enables a program in a server to be called by only specifying the program name without being aware of the IP address of the server.

Q33. What is the broadcast address of a network to which the IP address 192.168.57.123/22 belongs?

- a) 192.168.55.255
- b) 192.168.57.255
- c) 192.168.59.255
- d) 192.168.63.255

Q31. Which device performs protocol conversion between different types of networks, functioning at the layers of transport and above in the OSI basic reference model?

- a) Bridge b) Gateway c) Repeater d) Router

Q33. Which of the following is an appropriate characteristic of IPv6 addresses?

- a) All addresses are global.
- b) An address consists of 96 bits.
- c) There are several address representations, one of which uses a hexadecimal string with every four digits (i.e., 16 bits) separated by a colon “:”.
- d) There is a one-to-one correspondence between all IPv6 addresses and all IPv4 addresses.

Q34. There is a PC whose IP address and subnet mask are shown below. Which of the following is the network address of this PC?

IP address: 10.170.70.19

Subnet mask: 255.255.255.240

- | | |
|-----------------|------------------|
| a) 10.170.70.0 | b) 10.170.70.16 |
| c) 10.170.70.31 | d) 10.170.70.255 |

Q35 Which of the following is an Internet standard that extends the format of email messages to support non-ASCII text as well as audio, video, and images?

- a) HTML b) MHS c) MIME d) SMTP

Q32. Which of the following is the device that operates only at the physical layer of the OSI model?

- a) Bridge b) Repeater c) Router d) Switch

Q33. Which of the following is the maximum theoretical data rate (in Mbps) achievable in the IEEE 802.11n network?

- a) 11 b) 54 c) 248 d) 600

Q34. Which of the following is an architecture that decouples the network control and forwarding functions, enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services?

- a) Cloud computing
- b) Internet of things
- c) Network function virtualization
- d) Software-defined networking

Q35. In telecommunication, which of the following is a standard for wireless broadband communication for mobile devices and data terminals?

- a) IEEE 802.11
- b) LTE
- c) NFC
- d) UWB

Q36. Which of the following is an e-mail header field that is removed during the message transfer using SMTP?

- a) Bcc b) Date c) Received d) X-Mailer

Q31. In IPv4, which of following describes the NAT function of a router that connects some computers to the Internet?

- a) It caches the Internet access to speed up the connections when revisiting the same websites.
- b) It converts between private and global IP addresses.
- c) It inspects the IP packets in a transmission to detect possible attacks and intrusions from the Internet.
- d) It only passes the IP packets intended for specific terminals.

Q32. Which of the following is a feature of a switching hub (layer 2 switch) network device?

- a) It breaks a received packet into smaller pieces (fragments) in the network layer.
- b) It dynamically allocates an IP address for a terminal connected to its LAN port.
- c) It forwards a received packet only to its LAN port connected to a device with the packet's destination MAC address.
- d) It forwards a received packet to all its LAN ports (broadcast).

Q33. Which of the following is the network routing and addressing mechanism that is used in IPv6 but *not* in IPv4?

- a) Anycast b) Broadcast c) Multicast d) Unicast

Q34. In an IPv4 network with subnet mask 255.255.255.224, what is the maximum number of host addresses assigned?

- a) 14 b) 20 c) 26 d) 30

Q35. Which of the following is a protocol that uses TCP as its transport layer protocol?

- a) DHCP
- b) SNMP
- c) TELNET
- d) TFTP

Q32. Which of the following is the most appropriate information for a router to determine the destination of an incoming packet?

- a) Destination IP address
- b) Destination MAC address
- c) Source IP address
- d) Source MAC address

Q33. In the OSI basic reference model, which of the following is the layer where bridges operate?

- a) Application layer
- b) Network layer
- c) Datalink layer
- d) Transport layer

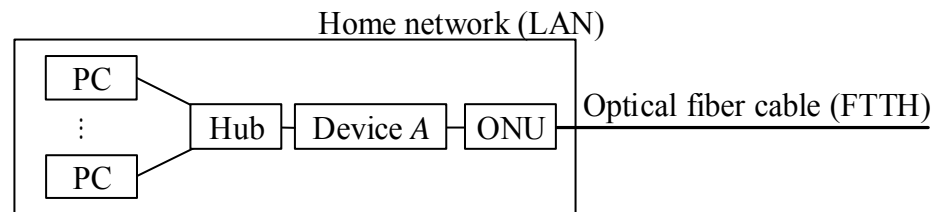
Q34. In TCP/IP, which of the following is an application layer protocol that enables a server to automatically configure its clients with network information such as IP addresses, the subnet mask and the default gateway address?

- a) ARP
- b) DHCP
- c) DNS
- d) NSLOOKUP

Q35. Which of the following is an appropriate explanation of SDN (Software-Defined Networking) that uses OpenFlow?

- a) It is a business analysis and visualization software technology that uses visual means such as data flow diagrams and activity diagrams to discover problems in business processes.
- b) It is a network technology that logically decouples the functions for data transfer and route control, and is implemented with a combination of network devices specialized for data transfer and software-based route control.
- c) It is an Internet of Things (IoT) technology that uses RFID, and is a software architecture for the optimization of logistics networks.
- d) It is an optimum relocation of servers on a network in order to efficiently deliver a range of software content such as music, videos, and online games over the Internet.

- Q36.** As shown below, multiple PCs are connected to the home network and they have access to the Internet through FTTH, and a global IP address is assigned to the WAN interface of device A. Which of the following is the function of device A that enables the PCs to use the Internet with this global IP address?



- a) DHCP
- b) NAT (IP Masquerade)
- c) Packet filtering
- d) PPPoE

Q31. Which of the following TCP/IP protocols is used to assign IP addresses dynamically?

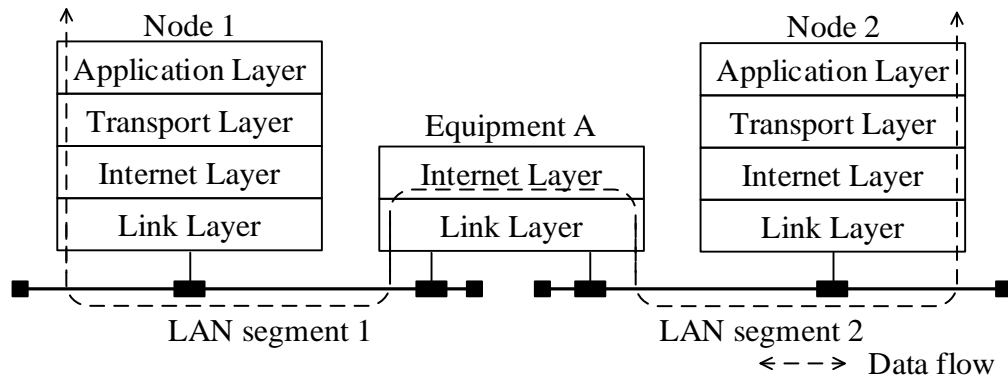
a) ARP

b) DHCP

c) RIP

d) SMTP

Q32. In a TCP/IP network hierarchical model, what is the name for Equipment A that connects two LAN segments at the Internet Layer?



a) Bridge

b) Repeater hub

c) Router

d) Switching hub

Q33. Which of the following is a pair of IP addresses belonging to the same subnet, when the subnet mask is 255.255.255.240?

- a) 192.168.1.14 and 192.168.1.17
- b) 192.168.1.17 and 192.168.1.29
- c) 192.168.1.29 and 192.168.1.33
- d) 192.168.1.33 and 192.168.1.49

Q34. Which of the following delivery models does an ARP response use?

- a) Anycast
- b) Broadcast
- c) Multicast
- d) Unicast

Q35. A PC and a web server are communicating via HTTP. When a request packet is sent from the PC to the web server, which of the following combinations of port numbers does the response packet have? Here, the source and the destination port numbers of the request packet are 50001 and 80 respectively.

	Source (web server) port number	Destination (PC) port number
a)	80	50001
b)	50001	80
c)	A number allocated on the web server, other than 80 and 50001	80
d)	A number chosen by the web server other than 80 or 50001	50001

Q45. Which of the following is an appropriate reason why VLANs are used?

- a) In order to obtain an IP address
- b) In order to reduce network traffic
- c) To remotely access the intranet from a public network
- d) To use a virtual memory system

Q30. Which of the following is located at layer 3 of the OSI basic reference model, and performs path selection and packet relay for an end-to-end communication?

- a) Data link layer
- b) Network layer
- c) Session layer
- d) Transport layer

Q31. When a PC connected to a LAN is starting up, which of the following protocols is used to automatically assign an IP address to the PC?

- a) DHCP b) DNS c) FTP d) PPP

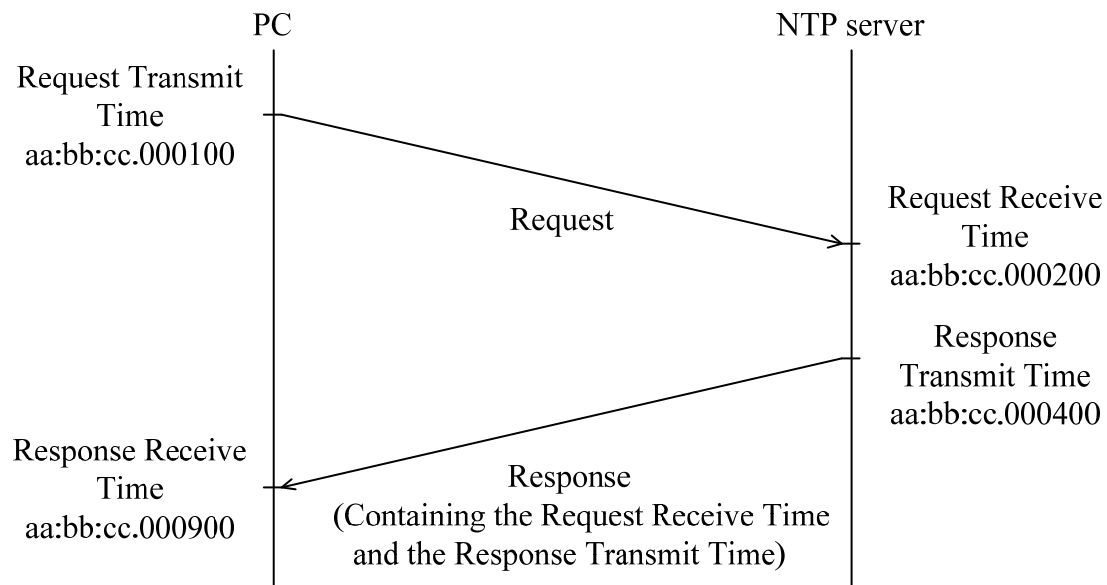
Q32. Which of the following describes an IPv6 feature not existing in IPv4?

- a) 128-bit addressing is introduced for the IP address space.
- b) An IP address is represented as a pair of a network address and a subnet mask.
- c) Private addresses are introduced to use IP addresses efficiently.
- d) Subnet masks are introduced to use the address space efficiently.

Q33. In TCP/IP network, which of the following is a combination of information that identifies a TCP connection?

- a) IP address, Session ID
- b) IP address, Port number
- c) MAC address, Session ID
- d) Port number, Session ID

Q34. The figure below shows the basic mechanism to synchronize clocks using the NTP. A response from the NTP server contains a Request Receive Time and a Response Transmit Time. The PC calculates the difference between its internal clock and the NTP server clock using the four times shown in the figure. How is the internal clock of the PC different from that of the NTP server? Here, the request and the response require the same transmission time, and each time in the figure shows the time on the internal clock of the PC or the NTP server. In an expression aa:bb:cc.ddd, aa, bb, cc, and ddd represent hour, minute, second, a fraction of a second (in microseconds), respectively.



- a) 100 microseconds fast
- b) 200 microseconds fast
- c) 500 microseconds fast
- d) 700 microseconds fast

Q44. When a packet filtering firewall controls packets by using a list of rules, which of the following is the rule that is applied to packet *A* and its action? Here, the firewall applies the rules shown in the list below in the order number 1–4, and if a rule is applied, then the remaining rules are not applied.

[List of rules]

Number	Source Address	Destination Address	Protocol	Source Port number	Destination Port number	Action
1	10.1.2.3	*	*	*	*	Blocked
2	*	10.2.3.*	TCP	*	25	Permitted
3	*	10.1.*	TCP	*	25	Permitted
4	*	*	*	*	*	Blocked

Note: * indicates a pattern that applies to any value.

[Packet *A*]

Source Address	Destination Address	Protocol	Source Port number	Destination Port number
10.1.2.3	10.2.3.4	TCP	2100	25

- a) Blocked by number 1
- b) Blocked by number 4
- c) Permitted by number 2
- d) Permitted by number 3

Q32. Which of the following is a routable IP address in the Internet?

a) 10.129.205.3

b) 172.40.77.4

c) 192.168.10.7

d) 192.168.203.5

Q33. Among the seven layers of the OSI basic reference model, which layer is responsible for forwarding packets, including routing them through intermediate routers?

- a) The data link layer
- b) The network layer
- c) The session layer
- d) The transport layer

Q34. In an IPv4 network, which of the following is the correct combination of an IP address class, its IP address range, and a subnet mask?

	class	range	subnet mask
a)	class A	1.0.0.0 ~ 127.255.255.255	255.0.0.0
b)	class B	128.0.0.0 ~ 191.255.255.255	255.255.0.0
c)	class C	192.168.0.0 ~ 223.255.255.255	255.255.255.0
d)	class D	224.0.0.0 ~ 239.255.255.255	255.255.255.255

Q35. Which of the following is an Internet service that translates a domain name such as **www.itpec.org** into its corresponding IP address?

- a) ARP b) DNS c) RARP d) TCP

Q36. Which of the following is an appropriate description of the *netstat* utility?

- a) It displays active TCP connections.
- b) It displays the contents of the DNS resolver cache.
- c) It displays the mapping between IP addresses and corresponding MAC addresses in the cache.
- d) It displays the route path to the specified destination and measures the packet delays.

Q31. In a CSMA/CD based LAN, which of the following is an appropriate description of the transmission operation performed by a network node?

- a) All nodes are connected in a ring topology, and a special frame is sent around to control the transmission right. Only the node that receives the special frame can transmit data.
- b) Each node checks if the transmission medium is in use, and can transmit data if the medium is not in use. If a conflict is detected, a retransmission occurs after a random interval of time.
- c) Each node is assigned a logical priority, and a transmission right is passed along in the order of priority. Only the node with the right can transmit data.
- d) Only the node that has been assigned a time slot for transmission can transmit data.

Q32. Which of the following is an appropriate description of network devices?

- a) A bridge relays frames based on IP addresses.
- b) A gateway converts protocols of the first through the third layers of the OSI basic reference model.
- c) A repeater extends transmission distances by amplifying signals between the segments of the same type.
- d) A router relays frames based on MAC addresses.

Q33. In a TCP/IP environment, which of the following is a standard for attaching image data to an email?

- a) JPEG
- b) MIME
- c) MPEG
- d) SMTP

Q34. Concerning email protocols, which of the following descriptions is correct?

- a) IMAP allows the message to remain on the server even after it is downloaded to a local PC.
- b) IMAP uses UDP for faster downloading of emails, whereas POP3 uses TCP.
- c) POP3 and IMAP uses the same port number for interoperability in email communication.
- d) POP3 is used for sending email messages from the sender's mail server to the receiver's mail server.

Q35. In IPv6 networks, what is the length of an IP address in bits?

- a) 32 b) 64 c) 128 d) 256

Q34. Which of the following is a data link layer function that enables receivers to control the amount of data to be received from the senders?

- a) Congestion control
- b) Error control
- c) Flow control
- d) Media access control

Q35. TCP/IP is a layered set of communication protocols consisting of the Network Interface layer, the Internet layer, the Transport layer, and the Application layer. Which of the following is a combination of the Transport layer protocols?

- | | |
|--------------|--------------|
| a) DHCP, TCP | b) HTTP, UDP |
| c) IP, TCP | d) TCP, UDP |

Q36. Which of the following is responsible for converting a domain name to a corresponding IP address?

- a) DHCP server
- b) DNS server
- c) IMAP server
- d) SMTP server

Q37. Which of the following is an appropriate description of Transmission Control Protocol (TCP)?

- a) It ensures reliability by retransmission of data segments if any of them is lost.
- b) It is an end-to-end protocol but does not have any mechanism for congestion control.
- c) It is connectionless and uses a checksum to ensure the integrity of the data.
- d) It is connection oriented but cannot operate if packets are received out of order.

Q38. On the Internet, sometimes when one tries to load a Web page by specifying a URL like `http://www.jitec.ipa.go.jp/`, the page does not show up and an error page is shown instead. However, one can browse this page correctly by specifying its IP address like this: `http://118.151.146.137/`. Which of the following TCP/IP layer is responsible for this problem?

- | | |
|----------------------------|--------------------|
| a) Application layer | b) Internet layer |
| c) Network Interface layer | d) Transport layer |

Q45. There is a network that is divided into three (3) segments, namely, an external segment, a demilitarized zone (DMZ), and an internal network by one (1) firewall. In the network, when a service for users is published on the Internet by using a system consisting of a Web server and a database (DB) server containing critical data, which of the following is the most appropriate method of server installation for protecting important data from unauthorized access from the Internet? Here, only a specific protocol is allowed for communication between the external segment and the DMZ, and between the DMZ and the internal network by the firewall, and communication between the external segment and the internal network is not allowed.

- a) The Web server and the DB server are installed in an internal network.
- b) The Web server and the DB server are installed in the DMZ.
- c) The Web server is installed in an external segment, and the DB server is installed in the DMZ.
- d) The Web server is installed in the DMZ, and the DB server is installed in an internal network.

Q31. Which of the following is the role of DNS in a TCP/IP network?

- a) A private IP address is translated into a global IP address in order to access the Internet.
- b) A program in a server can be invoked only by its name without taking the IP address of the server into consideration.
- c) In response to an assignment request of an IP address from a PC or a printer, an unused address is chosen from the addresses registered in the server.
- d) IP addresses are mapped to domain names, host names, and other such information.

Q32. In OSI basic reference model, what devices are used for segmentation or coupling of Physical layer, Data Link layer and Network layer respectively?

- a) Bridge, Repeater, Router
- b) Bridge, Router, Repeater
- c) Repeater, Bridge, Router
- d) Repeater, Router, Bridge

Q33. In TCP/IP networks, which command uses the ICMP “Echo”, “Echo Reply” and “Destination Unreachable” messages to test the reachability of the communication partner ?

- a) arp b) echo c) ipconfig d) ping

Q34. Which application protocol must support UDP as its transport layer protocol?

- a) DNS
- b) FTP
- c) HTTP
- d) Telnet

- Q35.** Which of the following is an appropriate explanation of POP3 used in e-mail systems?
- a) It is a protocol used to authenticate a user with his/her user ID and password after the PPP connection is established.
 - b) It is a protocol used to exchange e-mail messages between mail servers.
 - c) It is a protocol used to receive e-mail messages from the mailbox of a mail server.
 - d) It is a protocol used to send e-mail messages from a PC.

Q33. In the Internet environment, a computer is able to send the ping command “ping 11.22.33.44” to the web server (e.g., www.xyz.com) of Company XYZ and then receive an echo reply message successfully. Also, the computer is able to browse the website by using URL “http://11.22.33.44”, but cannot browse the same website by using “http://www.xyz.com”. In the OSI basic reference model, which of the following is the layer that is most likely to be responsible for such a problem?

- a) Application layer
- b) Data Link layer
- c) Network layer
- d) Session layer

Q34. In the IPv4 addressing scheme, when the subnet mask "255.255.255.224" is used for Class C, which of the following is the maximum number of effective hosts per subnet, excluding the network and broadcast addresses?

- a) 6 b) 30 c) 62 d) 254

Q35. Which of the following is the role of an ICMP protocol that is used as a network layer protocol of the OSI basic reference model?

- a) It allows multiple clients simultaneously connected to the same mailbox, and through flags stored on the server, different clients accessing the same mailbox at the same or different times can detect state changes made by other clients.
- b) It is used for messages to be generated and sent back to the source machine in order to indicate such faults as unreachable destinations, time limit exceeded, and parameter problems, and is also used by applications such as a ping command for diagnostic purposes.
- c) It is used by network management systems to communicate with network elements to monitor and control different aspects of the equipment.
- d) It sends routing-update messages at regular intervals and at the time of changes in the network topology. When a router receives a routing update that includes changes in the network topology, it updates its routing table to reflect the new route.

Q36. A system administrator has a plan to monitor a network in order to evaluate which employees are using an excessive amount of bandwidth on peer-to-peer sharing services. Which of the following is the most appropriate technique for achieving such a purpose?

- a) Dynamic packet filtering
- b) Packet sniffing
- c) Stateful packet inspection
- d) Static packet filtering

Q31. In computer networking, which of the following is the most appropriate technical term that means the variation in packet delay that causes the degradation of the QoS (Quality of Service) of real-time audio or video streaming service such as VoIP?

- a) Crosstalk b) Glitch c) Jitter d) Ripple

Q32. Which of the following is the network device that enables LANs to be interconnected at the physical layer of the OSI basic reference model?

- a) Bridge
- b) Gateway
- c) Repeater
- d) Router

Q33. Which of the following is a mechanism that enables a variety of information, such as still images, movies, and audio, to be sent via e-mail?

- a) FTP b) MIME c) POP3 d) TELNET

Q34. In a TCP/IP network using IPv4 addresses, which of the following is a valid network address? Here, the number following a slash (/) is the number (in decimal) of bits allocated to represent the network number.

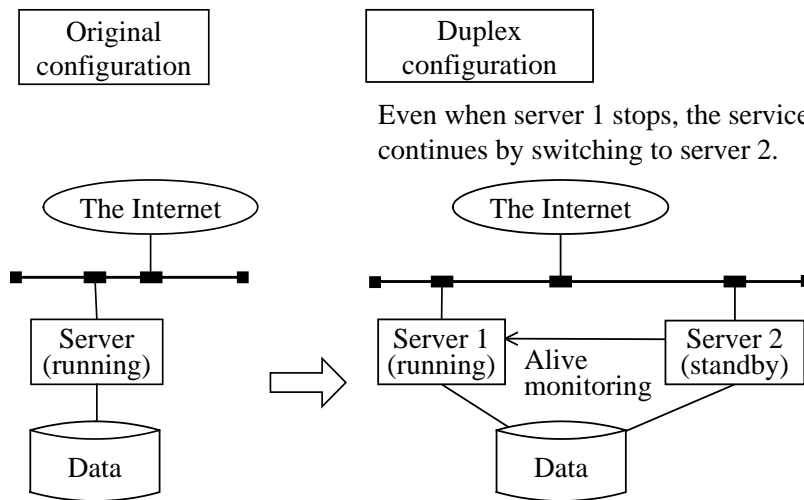
a) 123.0.0.30/27

b) 150.60.0.130/25

c) 196.74.38.20/28

d) 210.11.190.192/26

Q35. Which of the following is the effect that is expected by duplexing a server configuration, as shown in the figure below?



- a) Improvement in accountability
- b) Improvement in availability
- c) Improvement in confidentiality
- d) Improvement in integrity

Q43. When a packet filtering firewall controls packets in accordance with a list of rules as shown below, which of the following is the appropriate control for packet A defined below? Here, the firewall checks the rules in listed order. If any one of the rules is applied, the remaining rules are not checked.

[List of rules]

Number	Source Address	Destination Address	Protocol	Source Port number	Destination Port number	Action
1	10.1.2.3	*	*	*	*	Blocked
2	*	10.2.3.*	TCP	*	25	Permitted
3	*	10.1.*	TCP	*	25	Permitted
4	*	*	*	*	*	Blocked

Note: “*” represents an arbitrary value or pattern.

[Packet A]

Source Address	Destination Address	Protocol	Source Port number	Destination Port number
10.1.2.3	10.2.3.4	TCP	2100	25

- a) Blocked by number 1
- b) Blocked by number 4
- c) Permitted by number 2
- d) Permitted by number 3

Q37. Which of the following is an appropriate explanation concerning the NAT function of a router used for Internet connection?

- a) A specific bit pattern in IP packets being transmitted can be detected.
- b) Conversion between private IP addresses and global IP addresses can be performed.
- c) Frequently accessed Web pages can be cached to provide faster response times.
- d) Only the IP packets addressed to a specific terminal can be passed.

Q38. Which of the following is the appropriate protocol that is used on top of UDP for delivering real-time audio and video streams over the Internet?

- a) ARP b) ICMP c) NNTP d) RTP

Q39. Which of the following is an appropriate function of a switching hub (layer 2 switch) that is used as a network device?

- a) A received packet is divided (i.e., fragmented) into multiple packets in the network layer.
- b) A received packet is forwarded (i.e., broadcasted) to all LAN ports.
- c) A received packet is forwarded only to a LAN port corresponding to a destination MAC address.
- d) An IP address for a terminal connected to a LAN port is dynamically allocated.

Q40. In a TCP/IP network, which of the following is used to check if a computer or device is accessible across a network?

- a) BOOTP b) DHCP c) MIB d) ping

Q37. Which of the following is the unit of transmission that is handled in the data link layer of the OSI basic reference model and includes a header (and possibly a trailer) along with some number of units of upper-layer data?

- a) Datagram b) Frame c) Message d) Segment

Q38. In the traditional IPv4 addressing scheme, which of the following is the private IP address range that is reserved for Class B?

- a) 10.0.0.0 through 10.255.255.255
- b) 169.254.0.0 through 169.254.255.255
- c) 172.16.0.0 through 172.31.255.255
- d) 192.168.0.0 through 192.168.255.255

- Q39.** In a local area network using CSMA/CD as its access method, which of the following is an appropriate description concerning the transmission operation performed by a network node?
- a) All nodes are connected in a ring topology, and a special frame is sent around to control a transmission right. Only the node that receives it can transmit data.
 - b) Each node checks if the transmission medium is in use, and can transmit data if not in use. If a conflict is detected, retransmission is done after a random time interval.
 - c) Each node is assigned a logical priority, and a transmission right is passed along in order of priority. Only the node with the right can transmit data.
 - d) Only nodes that have been assigned a time slot for transmitting data can transmit data.

Q40. In the OSI basic reference model, which of the following is the appropriate layer that uses some common network programs and their corresponding protocols, such as HTTP, DHCP, and DNS?

- a) Application layer
- b) Network layer
- c) Session layer
- d) Transport layer

Q41. In a TCP/IP network environment, which of the following is the most appropriate information used by a router in order to determine the routing path of a packet?

- a) Destination IP address
- b) Destination MAC address
- c) Source IP address
- d) Source MAC address

Q37. Which of the following is an appropriate description concerning interconnection devices between LANs?

- a) The bridge relays frames based on the IP address.
- b) The gateway converts the protocols of only the first through third layers of the OSI basic reference model.
- c) The repeater extends the transmission distance by amplifying signals between the same types of segments.
- d) The router relays frames based on the MAC address.

Q38. Among the layers of the OSI basic reference model, which of the following is the appropriate layer that is primarily responsible for the translation, encryption, and compression of data?

- a) Data link layer
- b) Physical layer
- c) Presentation layer
- d) Session layer

Q39. In a TCP/IP network using IPv4 addresses, which of the following is an effective IP address that can be allocated to a network device?

- | | |
|--------------------|-----------------------|
| a) 172.16.5.0/40 | b) 192.168.251.256/25 |
| c) 203.164.15.9/28 | d) 252.169.15.40/30 |

Q40. Which of the following is an appropriate explanation of POP3 that is used in an e-mail system?

- a) It is a protocol used by the user to send an e-mail.
- b) It is a protocol used to authenticate a user based on the user ID and password after the establishment of a PPP link.
- c) It is a protocol used to exchange e-mail messages between mail servers.
- d) It is a protocol used to retrieve e-mails from the mailbox of a mail server.

Q39. In a TCP/IP network, when an IP packet of 2000 bytes is sent to the link that has an MTU (Maximum Transmission Unit) of 200 bytes, how many fragments are generated? Here, each packet has a 20-byte IP header.

- a) 9 b) 10 c) 11 d) 12

Q40. When a repeater hub (or simply referred to as a hub), a router, and an L2 switch (or simply referred to as a switch) are used as network devices in order to interconnect LANs based on the OSI basic reference model, which of the following is an appropriate combination that matches each device to its corresponding OSI layer?

	Physical layer	Data link layer	Network layer
a)	Hub	Router	Switch
b)	Hub	Switch	Router
c)	Router	Hub	Switch
d)	Switch	Router	Hub

Q41. Which of the following is the IP address range that is reserved for Class B in traditional IPv4 addresses?

- a) 127.0.0.1 through 127.255.255.255
- b) 128.0.0.0 through 191.255.255.255
- c) 172.16.0.1 through 172.31.255.255
- d) 192.168.0.1 through 192.168.255.255

Q42. Which of the following is the most appropriate description concerning the usage of NTP (Network Time Protocol)?

- a) It checks the last time stamp for a shared file stored on a file server to determine if it is the latest version.
- b) It compares the time that each e-mail is received on a mail server, and then forwards unread e-mails.
- c) It measures the response time of business programs accurately in a client/server system.
- d) It works with clients connecting to a time server in order to synchronize the time of every client that is distributed on the network.

Q37. Which of the following is the server that can be used to intercept all messages entering and leaving the network and to effectively hide the true network addresses?

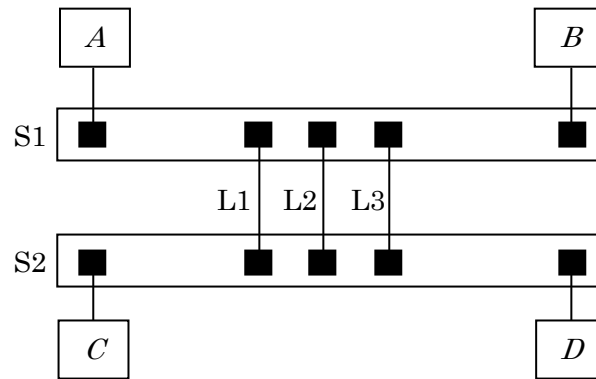
- a) DHCP server
- b) DNS server
- c) E-mail server
- d) Proxy server

Q38. Which of the following is the data transmission technique that has features or characteristics shown below?

- It is designed for cost-efficient data transmission for intermittent traffic between LANs and between end-points in a WAN.
- Data is transmitted in a variable-size unit.
- Error correction (i.e., retransmission of data) is left up to the end-points.
- It is based on the X.25 protocol, but it is faster because of a simplified X.25 protocol with minimal services.
- It provides a mid-range service between ISDN and ATM.

- | | |
|----------------------|---------------------|
| a) Cell relay | b) Frame relay |
| c) Message Switching | d) Packet Switching |

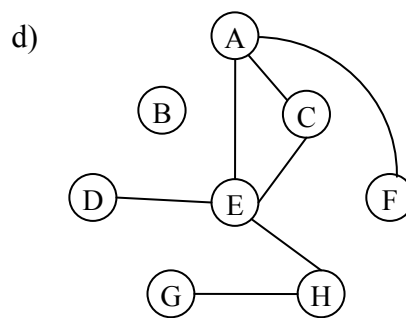
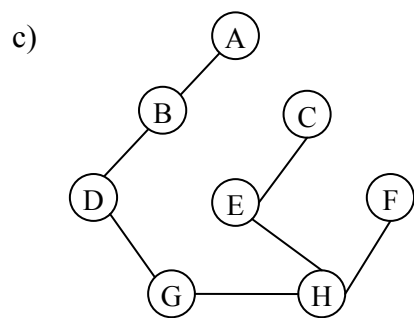
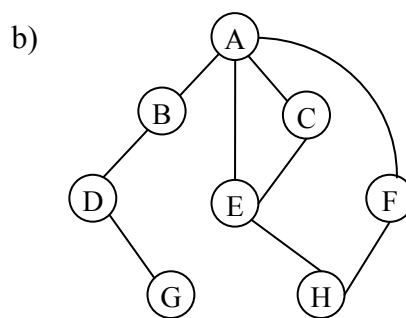
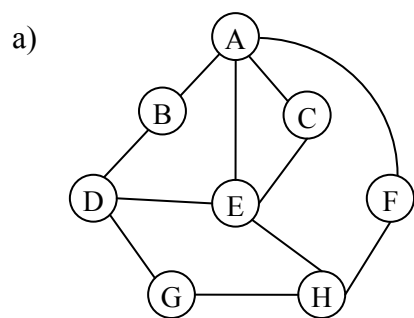
Q39. In the network shown below, the STP (Spanning Tree Protocol) is used on both S1 and S2 switches. When the link between two PCs *A* and *C* is established via L1, which of the following is the appropriate link that is used to transfer data between two PCs *B* and *D*?



- a) Always L1
- b) Always L2
- c) Always L3
- d) Either L2 or L3

- Q40.** In a URL (Uniform Resource Locator) specified to access a Web page through the Internet, which of the following is the appropriate sequence of four basic parts: the name of the Web page, directory and/or subdirectory which holds the Web page, access protocol, and host name?
- a) host name, protocol, directory, page
 - b) host name, protocol, page, directory
 - c) protocol, host name, directory, page
 - d) protocol, page, directory, host name

Q5. Among network topologies represented using graphs, which of the following can be regarded as a spanning tree?



Q36. Which of the following is the broadcast MAC address that is used by multiple protocols, such as ARP (Address Resolution Protocol) and RIP (Routing Information Protocol), in order to transmit data to all of the hosts on the local subnet?

- | | |
|----------------------|----------------------|
| a) 00-00-00-00-00-00 | b) EE-FF-EE-FF-EE-FF |
| c) F0-F0-F0-F0-F0-F0 | d) FF-FF-FF-FF-FF-FF |

Q37. In an IPv4 environment, when the subnet mask “255.255.255.224” is used for a class C network, how many IP addresses including reserved or ineffective addresses can be assigned to subnets and hosts per subnet respectively?

	Number of IP addresses	
	Subnet	Host
a)	8	32
b)	16	16
c)	16	32
d)	32	8

Q38. Which of the following is the appropriate layer of the OSI basic reference model that provides RPC (Remote Procedure Call) support, maintains the integrity of the connection between nodes, and controls data exchange?

- a) Application layer
- b) Network layer
- c) Presentation layer
- d) Session layer

Q39. Which of the following is a connectionless protocol that offers speed and low overhead as its primary advantage in the transport layer of the OSI basic reference model?

- a) ARP
- b) ICMP
- c) IP
- d) UDP

Q40. Which of the following is a protocol used by the ping command in order to verify that the communication link between source and destination is working in the TCP/IP network environment?

- a) ARP b) ICMP c) SMTP d) SNMP

Q41. Which of the following is an appropriate combination of information that a DHCP server dynamically provides for a client host to participate in the TCP/IP network?

- a) IP address, MAC address, default gateway address, and DNS server address
- b) IP address, MAC address, DNS server address, and routing information
- c) IP address, subnet mask, default gateway address, and DNS server address
- d) IP address, subnet mask, default gateway address, and routing information

Q42. Which of the following is the appropriate combination that is defined as a socket address in TCP/IP network environments?

- a) IP address and port number
- b) IP address and socket number
- c) MAC address and port number
- d) MAC address and socket number

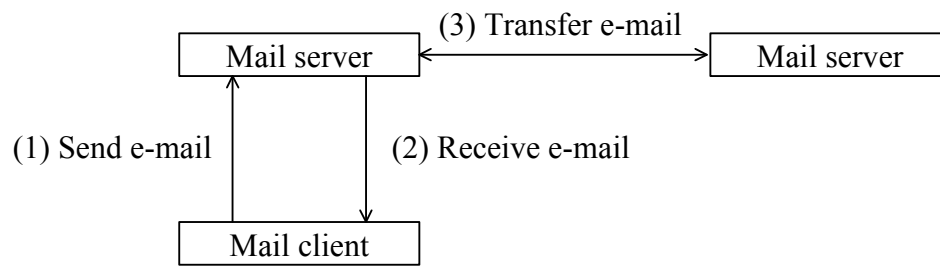
Q36. Which of the following is an appropriate explanation concerning the function of a proxy server?

- a) It is a centralized point of access to the Internet, and also provides an effective and efficient way to improve network performance by memory and disk caching of commonly visited web sites.
- b) It is used for translating, or resolving, domain names into IP addresses. Every time a domain name is entered, it resolves that name to the appropriate IP address and allows communication across the Internet.
- c) It provides a simple and secure way to upload and download information, either text or graphics, between the server and clients over the Internet.
- d) It provides a way to manage and automate the assignment of IP addresses from a central point, and sends a new IP address and other network configuration information automatically when a client is plugged into the Internet.

Q37. In the OSI basic reference model, which of the following is the appropriate layer that provides end-to-end communication services for applications, and also provides convenient services such as connection-oriented or connectionless data stream support, reliability, flow control, and congestion control?

- a) Data link layer
- b) Network layer
- c) Session layer
- d) Transport layer

Q38. Which of the following is an appropriate combination of the protocols that are used for transmitting and receiving e-mail as shown in the diagram below?



	(1)	(2)	(3)
a)	POP3	POP3	SMTP
b)	POP3	SMTP	POP3
c)	SMTP	POP3	SMTP
d)	SMTP	SMTP	SMTP

Q39. Which of the following describes the role of DNS in the TCP/IP network?

- a) Allocating an unused IP address from the IP addresses registered in the server, in response to a request from a PC for IP address assignment
- b) Enabling access to the Internet by converting an in-company private IP address into a global IP address
- c) Linking a name, such as a domain name or a host name, with an IP address
- d) Making it possible to call a program in a server by specifying its name without regard to the IP address of the server

Q40. When the CRC (Cyclic Redundancy Check) function is implemented by calculating a generator polynomial, which of the following is used as a CRC code (sometimes simply called CRC)?

- a) Dividend b) Quotient c) Remainder d) Summation

Q36. Which of the following information in IP header is used for routing the IP packets across networks?

- a) Destination address and source address fields
- b) Destination address field
- c) Destination address, source address, and protocol fields
- d) Source address field

Q37. Which of the following network topologies is commonly used, especially in Fast or Gigabit Ethernet, for connecting network devices via a centralized unit such as a hub or a switch?

- a) Bus b) Mesh c) Ring d) Star

Q38. What is the minimum number of communication cables that are needed to connect six network devices in a full mesh topology? Here, at least one communication cable is required to connect two network devices.

- a) 5 b) 6 c) 12 d) 15

Q39. Which of the following is the IP network addressing and routing scheme whereby data is routed to the “nearest” or “best” destination as viewed by the routing topology?

- a) Anycast b) Multicast c) Singlecast d) Unicast

Q40. Which of the following protocols can be used to access e-mail messages that are stored on a remote, and possibly shared, mail server, and thereby are manipulated from a desktop computer at home, a workstation at the office, and a notebook computer while traveling, without the need to transfer messages back and forth between these computers?

- a) FTP b) IMAP c) POP3 d) SMTP

Q39. Which of the following protocols can be used to temporarily assign an IP address leased from the pool to the host that asks for an address or to repeatedly assign the same IP address to the host according to the MAC address of the host?

- a) ARP b) DHCP c) SIP d) SNMP

Q40. Which of the following can be used to interconnect multiple LANs on the network layer (layer 3) of the OSI basic reference model and to relay packets of data?

- a) Bridge b) Gateway c) Repeater d) Router

Q41. When the subnet mask 255.255.255.240 is used for a server, which of the following is a valid IP address of the server?

- | | |
|-------------------|-------------------|
| a) 193.144.134.31 | b) 194.123.178.16 |
| c) 195.206.108.25 | d) 196.168.206.47 |

Q42. Which of the following is the signaling protocol that is widely used to initiate, manage, and terminate multimedia communication sessions, such as voice and video calls over the Internet?

- a) RTP b) SIP c) SMTP d) SNMP

Q43. Which of the following is a security feature that can allow network administrators to specify exactly which stations should have access to the wireless network?

- a) IP address filtering
- b) MAC address filtering
- c) Packet filtering
- c) URL filtering

Q53. Which of the following appropriately explains the function of the transport layer in the OSI basic reference model?

- a) It is responsible for establishing, managing, and terminating communication connections between the applications running in different nodes, and provides means for dialogue control between end systems.
- b) It is responsible for maintaining reliable end-to-end communications and data transfer between systems across the network, and provides a variety of functions including flow control, virtual circuit, and error checking and recovery.
- c) It provides a set of interfaces for applications to obtain access to networked services as well as access to a variety of network services that support applications directly.
- d) It provides a variety of coding and conversion functions which ensure that information sent from the application layer of one system is readable by that of another system.

Q54. Which of the following is the appropriate statement concerning the number of host addresses available to one sub-network in IPv4?

- a) The number of host addresses available in a sub-network is always fixed, depending on the class of IP address; 2^8 for class A, 2^{16} for class B, and 2^{24} for class C.
- b) The number of host addresses available in a sub-network is always fixed, depending on the class of IP address; 2^{24} for class A, 2^{16} for class B, and 2^8 for class C.
- c) The number of host addresses available in a sub-network is determined by the number of “0” bits in the subnet mask.
- d) The number of host addresses available in a sub-network is determined by the number of “1” bits in the subnet mask.

Q55. Which of the following is the local broadcast address to be used by a computer with IP address 202.130.17.63 and subnet mask 255.255.255.0 if classless addressing is used?

- a) 202.130.0.0
- b) 202.130.0.1
- c) 202.130.17.1
- d) 202.130.17.255

Q57. When MAC (Media Access Control) frames defined by IEEE 802.3 are transmitted over Ethernet, which of the following methods is used for error detection?

- a) Checksum
- b) CRC
- c) Hamming code check
- d) Parity check

Q58. Which of the following methods is used for avoiding unnecessary collisions in the IEEE 802.11 family of wireless LAN standards?

- a) CDMA
- b) CSMA/CA
- c) CSMA/CD
- d) TDMA

Q59. VLAN (Virtual LAN) is used to logically segment a LAN into different broadcast domains. In which of the following network devices should the function of VLAN be supported?

- a) Bridge
- b) Hub
- c) Repeater
- d) Switch

Q36. When a corporate intranet is connected to the Internet, which of the following mechanisms works as a bridge to access the Internet, enables high-speed access by caching Web content, and then is used to ensure security?

- a) DMZ
- b) Firewall
- c) IP masquerade (NAPT)
- d) Proxy

Q53. When the subnet mask “255.255.255.0” is used in a “class A” network, how many host addresses can be assigned to network devices?

a) 254

b) 256

c) 2^{16}

d) 2^{24}

Q54. Which of the following protocols is used in mail servers on a TCP/IP network?

- a) DHCP b) SMTP c) SNMP d) TELNET

Q55. Which of the following protocols is supported by the transport layer of the OSI basic reference model?

- a) HTTP b) IP c) PPP d) TCP

Q56. Which of the following is the network topology that is used to connect one central node or hub with point-to-point links to several other nodes?

- a) Bus b) Mesh c) Ring d) Star

Q57. In home and office networks of Fast or Gigabit Ethernet, which of the following cables can be used as a lower cost option for connecting a client PC to the network?

- a) Coax b) Fiber-optic c) STP d) UTP

Q58. Which of the following is a device that interconnects LANs at the physical layer of the OSI basic reference model?

- a) Bridge b) Gateway c) Repeater d) Router

Q59. Which of the following is the most appropriate information used by routers in order to determine the routing paths of packets?

- a) Destination IP address
- b) Destination MAC address
- c) Source IP address
- d) Source MAC address

Q53. An IP address in IPv4 consists of two parts: the network address part and the host address part. Which of the following is the appropriate description concerning the network address and the host address? Here, n is the number of bits in the network address part, and h is the number of bits in the host address part. In addition, the special-purpose and ineffective addresses should not be counted as an effective address.

- a) In classes A, B, and C, the maximum number of effective host addresses available to one network is defined as $2^h - 2$.
- b) In classes A, B, and C, the maximum number of effective network addresses available is defined as 2^n .
- c) In class A, the maximum number of effective host addresses available to one network is defined as $2^h - 2$, but in classes B and C it is defined as 2^h .
- d) The maximum number of effective network addresses available is defined as $2^n - 2$, where $n=7$ in class A, $n=14$ in class B, and $n=21$ in class C.

Q54. Which of the following terms can be applicable to an explanation below?

“The sender sends a single datagram; the routers are responsible for making copies and sending them to a group of interested receivers.”

- a) Anycast b) Broadcast c) Multicast d) Unicast

Q55. Which of the following is a protocol for e-mail on the Internet that supports not only text but other data such as audio and images through message header extension?

- a) HTML b) MHS c) MIME d) SMTP

Q56. Which of the following is the appropriate description concerning ATM exchange?

- a) It is a general term referring to a private branch exchange used for connection between internal extension telephones located within a limited area such as an office or for connection between subscribers' telephone lines and internal extension telephones.
- b) It is a store-and-forward type of exchange device that transfers data by dividing the data into blocked units. The transfer speed is only up to about several tens of Kbps.
- c) It is an exchange device that exchanges data divided up into units called frames. Since it does not re-send data when a transfer error occurs, it can increase the processing speed in the network.
- d) It is an exchange device that handles a variety of data in an integrated way by partitioning data into fixed-length blocks called cells and adding a header containing destination information to each cell.

Q57. Which of the following protocols is used for synchronizing the clocks in multiple nodes on the Internet?

- a) NNTP b) NTP c) SMTP d) SNMP

Q58. Which of the following is a mechanism that allows a Web server to store its own information about a user on the user's own computer so that the Web server can identify users and possibly prepare customized Web pages for them?

- a) Cookie b) Password c) SSL d) URL

Q59. Which of the following is the mechanism for interfacing a Web server with an external program in order to implement an interactive page where an application program on the server executes a request from a client and returns the resulting output to the browser?

- a) CGI b) HTML c) MIME d) URL

Q35. Which of the following appropriately describes a typical feature of ADSL?

- a) By separating the frequency bands used by analog telephones and data communications, it allows both of these connections to be used simultaneously.
- b) Compared to single use of a PC, the use of a splitter reduces the communication speed when both analog telephone and the PC are used at the same time.
- c) It achieves high-speed communication by using a bundle of multiple channels of 64Kbps.
- d) The communication speed varies between upstream (from the user to the telephone company) and downstream; it is suitable for communication applications where the amount of upstream data is large.

Q51. When a network device is connected to the LAN with the network address of 201.12.1.64 and the subnet mask of 255.255.255.192, which of the following IP addresses should NOT be assigned to the device on the network?

- a) 201.12.1.65
- b) 201.12.1.96
- c) 201.12.1.126
- d) 201.12.1.127

Q52. Which of the following is the appropriate protocol that is widely used with TCP/IP networks to collect and manage information from network devices such as servers, routers, switches, and hubs?

- a) HTTP b) HTTPS c) SMTP d) SNMP

Q53. Which of the following is the appropriate protocol that is used to send e-mail messages from one server to another over the Internet?

- a) FTP b) HTTP c) POP3 d) SMTP

Q54. Which of the following operations is performed on the packet header while the data packet moves from the lower to upper layers according to the OSI basic reference model?

- a) Header addition
- b) Header deletion
- c) Header modification
- d) Header rearrangement

Q55. Which of the following occurs when computer A broadcasts an ARP request to find the MAC address of computer B on the same network?

- a) All computers in network receive the request from A , and all of them reply to A with the MAC address of B .
- b) All computers in network receive the request from A , and only B replies to A with its MAC address.
- c) DNS server replies to A with the MAC address of B .
- d) The nearest router that receives the request from A replies to A with the MAC address of B or forwards the request to another router.

Q57. Which of the following is the key technology that enables to connect a computer using a private IP address to the Internet?

- a) BOOTP b) DHCP c) NAT d) RARP

Q58. Which of the following provides the function of mapping between domain names and IP addresses in a TCP/IP network?

- a) DHCP b) DNS c) SNMP d) Proxy

Q59. Which of the following is an appropriate purpose of installing a firewall in a computer network?

- a) To authenticate internal users
- b) To block and permit data traffic
- c) To protect a computer from computer viruses
- d) To verify company policies

Q60. Which of the following subnet masks provides the minimum number of IP addresses available in the subnet to assign to devices that request a connection?

- | | |
|--------------------|--------------------|
| a) 255.255.255.0 | b) 255.255.255.248 |
| c) 255.255.255.252 | d) 255.255.255.254 |

Q61. In the OSI basic reference model, which of the following layers provides a set of rules for establishing and terminating the connection between applications on computer systems?

- a) Data link layer
- b) Network layer
- c) Session layer
- d) Transport layer

Q62. Which of the following protocols is used on the transport layer of OSI basic reference model?

- a) FTP
- b) PPP
- c) SNMP
- d) UDP

Q63. Which of the following is the appropriate technology that is used to establish a private or secure network connection within a public IP network, such as the Internet, and to give the company the same capabilities at much lower cost by using the shared public infrastructure rather than a private one?

- a) Firewall b) PAT c) RPC d) VPN

Q64. Which of the following IP addresses can be used to connect a computer directly to the Internet?

a) 10.10.11.88

b) 127.0.0.1

c) 172.16.255.255

d) 203.162.1.160

Q65. Which of the following is the appropriate specifications concerning 100Base-T?

	Transmission media	Network topology	Maximum length of one segment (unit: meter)
a)	Coaxial cable	Bus	500
b)	Coaxial cable	Star	100
c)	Twisted pair cable	Bus	500
d)	Twisted pair cable	Star	100

Q60. In the OSI 7-layer model, which of the following layers converts data from the upper layer into many tiny pieces called segments for transmission across the network?

- a) Data Link Layer
- b) Network Layer
- c) Physical Layer
- d) Transport Layer

Q61. Which of the following is the appropriate protocol that can deliver data from sender to receiver, correctly and in order?

a) IP

b) RARP

c) SNMP

d) TCP

Q62. Which of the following protocols is used in a TCP/IP network to provide a virtual terminal function that enables remote login to a host for remote operation?

- a) FTP b) HTTP c) SMTP d) TELNET

- Q63.** When constructing a network with a TCP/IP environment, IP address management becomes cumbersome and complicated as the number of clients becomes larger. Which of the following protocols is able to increase the efficiency of IP address management by assigning IP addresses dynamically according to requests from clients?
- a) DHCP b) HTTP c) LDAP d) SNMP

Q64. Which of the following is an appropriate statement in regard to the transmission operation of nodes connected to a LAN in the CSMA/CD method?

- a) Each node checks whether the carrier is busy and can transmit only if the carrier is not busy. When collision is detected, transmission is tried again after a random time has elapsed.
- b) Each node is assigned a logical ranking, the transmission privilege is passed on down the nodes in order of this ranking, and only the node that has received this privilege can transmit.
- c) Only the node that has been assigned a time slot can transmit.
- d) The nodes are connected in a ring, a special frame for controlling transmission privileges is circulated, and only the node that has received this frame can transmit.

Q31. Audio data of 2.4 Mbytes encoded at 192 kbit/s is to be downloaded and played back without interruptions over a network with a communication speed of 128 kbit/s. What is the minimum number of seconds required as the data buffering time before the start of playback?

- a) 50 b) 100 c) 150 d) 250

Q32. There exists a system that connects a head office to a factory via a leased line and sends form data. The size of each form is 2,000 bytes, and header data totaling 400 bytes is attached to every two (2) forms to be sent through this system. On average, 100,000 forms per hour are generated. When the line speed is 1 Mbit/s, what is the line's utilization rate in percentage?

- a) 6.1 b) 44 c) 49 d) 53

Q2. Which of the following is a decimal that is represented as a finite digit octal fraction?

a) 0.3

b) 0.4

c) 0.5

d) 0.8

Q30. Which of the following is the response time when a client and server at different locations communicate under the conditions below? Here, the response time is in seconds and starts from the moment the client sends a message until a response is received from the server. 1 MB is 10^6 bytes. The propagation delay between the client and server can be ignored.

[Conditions]

Line speed between client and server	8 Mbit/s
Transmission efficiency	60%
Message size	1 MB for upstreaming and 2 MB for downstreaming
Processing time at client side	Total of 0.4 s for sending and receiving
Processing time at server side	Total of 0.4 s for sending and receiving

- a) 1.4 b) 3.8 c) 5.0 d) 5.8

Q30. Approximately how many seconds is required to transmit a file of 10^6 bytes via a 64-kbit/s communication line? Here, the transmission efficiency of the line is 80%.

- a) 19.6 b) 100 c) 125 d) 156

Q32. Locations A and B , both on the ground, communicate via a geostationary satellite at an altitude of about 36,000 km. When the distance between each location and the satellite is 37,500 km, and the delay caused by the relay at the satellite is 10 milliseconds, what is the total delay in seconds for the data sent from A to arrive at B ? Here, the propagation speed of radio waves is 3×10^8 m per second.

- a) 0.13 b) 0.26 c) 0.35 d) 0.52

Q2. What is the Hamming distance of bit strings 10101 and 11110?

a) 0

b) 2

c) 3

d) 5

Q5. When a 200-byte message is sent at 100 Kbps by using a 10 km cable with a propagation speed of 2×10^8 m/sec, which of the following is the total delay in milliseconds? Here, the total delay can be defined as the sum of the transmission and propagation delays, and there is no processing delay.

- a) 2.00 b) 2.05 c) 16.00 d) 16.05

Q6. Each character in a text file is encoded as a double-byte character, and then the file is transmitted with 4 KB header information through a serial communication interface at a speed of 1,000 bps. When a text file consists of 100,000 characters, how long in seconds does it take to continuously transmit the file and its header? Here, 1 KB is 1,000 bytes.

- a) 104 b) 204 c) 832 d) 1632

Q36. When an optical fiber cable is used for data communication, which of the following is the approximate bandwidth (in units of THz) of the light within the range of wavelength from 1000 to 1400 nanometers? Here, in consideration of data transmission efficiency and such other factors, the effective speed of the light on the optical fiber cable can be assumed to be 2×10^8 m/s.

- a) 50 b) 57 c) 75 d) 86

Q38. Time Division Multiplexing (TDM) is a type of digital multiplexing where two or more bit streams (or signals) are transferred apparently simultaneously as multiple channels or time slots in one physical communication line, but are physically taking turns on the channel. The time domain is divided into several recurrent time slots of fixed length, one for each channel. One TDM frame consists of one time slot per channel and its related overhead such as synchronization and error correction. Approximately how long in seconds does it take to transmit 4 Kbytes of data over one channel of a 512 Kbps communication line using TDM with 8 channels? Here, any overhead for synchronization or other purposes can be ignored.

- a) 0.06 b) 0.5 c) 8 d) 64

Q56. When a 9-Kbyte data file is transmitted using the asynchronous (or start-stop) communication protocol at a speed of 2,400 bps, what is the “overhead” (time spent on sending start, stop, and parity bits except data bits) in seconds? Here, a start bit is first sent, followed by eight data bits, no parity bit, and one stop bit, for each byte of the data file.

- a) 7.5 b) 11.25 c) 30 d) 37.5

Q65. A message consists of 200 characters. If we can transmit 200 messages on average before a 1-bit error occurs, what is the bit error rate of the transmission line? Here, 1 character equals to 2 bytes while 1 byte equals to 8 bits.

- a) $1/640000$ b) $1/320000$ c) $1/80000$ d) $1/64000$