Network Chapter # 22
INTERNET APPLICATIONS
Review Questions:

22.1 What is the difference between the RFC 821 and RFC 822?
RFC 821 defines SMTP which is the protocol for exchanging email messages. RFC 822 describes the format of those messages.

22.2 What are the SMTP and MIME standards?
The Simple Mail Transfer Protocol (SMTP) is the standard protocol in the TCP/IP protocol suite for transferring mail between hosts. Multipurpose Internet Mail Extension (MIME) is an extension of SMTP to address some of its problems and limitations. MIME addresses SMTP’s inability to directly transmit executables and other binary files and provides support for national language characters that SMTP does not directly support.

22.3 What is the difference between a MIME content type and a MIME transfer encoding?
Content-Type: Describes the data contained in the body with sufficient detail that the receiving user agent can pick an appropriate agent or mechanism to present the data to the user or otherwise deal with the data in an appropriate manner. Transfer-Encoding: Indicates the type of transformation that has been used to represent the body of the message in a way that is acceptable for mail transport.

22.4 Briefly explain radix-64 encoding.
R64 converts a raw 8-bit binary stream to a stream of printable ASCII characters. Each group of three octets of binary data is mapped into four ASCII characters.

22.5 What is a network management system?
A network management system is a collection of tools for network monitoring and control that is integrated in the following senses:
(1) A single operator interface with a powerful but user-friendly set of commands for performing most or all network management tasks.
(2) A minimal amount of additional equipment. That is, most of the hardware and software required for network management is incorporated into the existing user equipment.

22.6 List and briefly define the key elements of SNMP.
Management station: typically a standalone device, but may be a capability implemented on a shared system. In either case, the management station serves as the interface for the human network manager into the network management system. Agent: Key platforms, such as hosts, bridges, routers, and hubs, may be equipped with agent software so that they may be managed from a management station. The agent responds to requests for information from a management station, responds to requests for actions from the management station, and may asynchronously provide the management station with important but unsolicited information.
Management information base (MIB): To manage resources in the network, each resource is represented as an object. An object is, essentially, a data variable that represents one aspect of the managed agent. The collection of objects is referred to as a MIB.

Network management protocol: used for the exchange of management commands, responses, and information between management stations and agents.

22.7 What functions are provided by SNMP?
The Simple Network Management Protocol (SNMP) is the network management tool for TCP/IP networks. It provides the following three basic capabilities:
(i) Get: enables the management station to retrieve the value of objects at the agent;
(ii) Set: enables the management station to set the value of objects at the agent;
(iii) Trap: enables an agent to notify the management station of significant events.

22.8 What are the differences among SNMPv1, SNMPv2, and SNMPv3?
SNMPv2 extends the original version SNMPv1 by providing support for decentralized network management and efficient transfer of large blocks of data.
SNMPv3 provides a security capability to be used with SNMPv1 or SNMPv2.

Problems
22.1 Electronic mail systems differ in the manner in which multiple recipients are handled.
In some systems, the originating user agent or mail sender makes all the necessary copies and these are sent out independently. An alternative approach is to determine the route for each destination first. Then a single message is sent out on a common portion of the route and copies are only made when the routes diverge; this process is referred to as mail-bagging. Discuss the relative advantages and disadvantages of the two methods. Mail-bagging economizes on data transmission time and costs. It also reduces the amount of temporary storage that each MTA must have available to buffer messages in its possession. These factors can be very significant in electronic mail systems that process a large number of messages. Routing decisions may keep mail-bagging in mind.

22.2 Excluding the connection establishment and termination, what is the minimum number of network round trips to send a small email message using SMTP?
Six round trips: The HELO command, MAIL, RCPT, DATA, body of the message, and QUIT.

22.3 Explain the differences between the intended use for the quoted-printable and Base64 encodings
The quoted-printable encoding is intended to be used when the data largely consists of printable characters in the US-ASCII character set. The result is a somewhat human readable output.
The Base64 encoding is a uniform encoding mechanism, intended to encode arbitrary sequences of bytes, resulting in a non human-readable output.

22.4 Suppose you need to send one message to three different users: user1@example.com, user2@example.com, and user3@example.com. Is there any difference between sending one separate message per user and sending only one message with multiple (three) recipients? Explain.
If a separate message is sent for each of the users, one MAIL, one RCPT and one DATA command will be issued for each of the messages, resulting in the transmission of three copies of the message data.
If only one message with multiple recipients (three) is sent, one MAIL, multiple RCPT and one DATA command will be issued, resulting in the transmission of only one copy of the message data.
22.5 We’ve seen that the character sequence “<CR><LF>.<CR><LF>” indicates the end of mail data to a SMTP-server. What happens if the mail data itself contains that character sequence?
If the mail data itself contains the character sequence ”<CR><LF>.<CR><LF>”, the SMTP-client will insert an additional period at the beginning of the line, thus transmitting it as ”<CR><LF>..<CR><LF>”.

22.6 Users are free to define and use additional header fields other than the ones defined in RFC 822. Such header fields must begin with the string “X-”. Why?
RFC 822 guarantees that the string ”X-” will never be used in extension-fields, thus this avoids any problems between official and private header fields.

22.7 Suppose you find some technical problems with the mail account user@example.com. Who should you try to contact in order to solve them?
RFC 822 ("Standard for Internet Text Messages") requires mailbox "postmaster" to be valid at each site, in order to contact a person with responsibility for the general operation of the site. So in this case you should send an e-mail to postmaster@example.com.

22.8 Although TCP is a full-duplex protocol, SMTP uses TCP in a half-duplex fashion. The client sends a command and then stops and waits for the reply. How can this half duplex operation fool the TCP slow start mechanism when the network is running near capacity?
Consider the first four network round trips. Each is a small command (probably a single segment) that places little load on the network. If all five make it through to the server without retransmission, the congestion window could be five segments when the body is sent. If the body is large, the client could send the first five segment at once, which the network might not be able to handle.

22.10 Because SNMP uses two different port numbers (UDP ports 161 and 162), a single system can easily run both a manager and an agent. What would happen if the same port number were used for both?
If the same port were used for both traps and requests, separating the manager from the agent in the same system would be difficult.