CS 372 Introduction to Computer Networks
Self-Check Exercises: Lecture 12 **Solutions**

1) Is FTP a peer-to-peer or client/server protocol? Client/Server

2) What states does the FTP protocol maintain?
Current Directory, Earlier Authentication, Limit on Concurrent Connections, etc…

3) Why does FTP open two connections for a file transfer?
The first connection is for commands. This "command" connection allows the server to maintain the client state, so the client can traverse directories, etc., on the server. When a file download/upload is requested, the server opens a new connection that is exclusively for transferring the file. This "data" connection is closed when the file transfer is complete, but the "command" connection stays open until it is explicitly closed by either the client or the server.

4) What are the three major components of e-mail?
User agent (such as an email client, or webmail); a mail server; an email protocol.

5) Why are separate protocols required for sending email and receiving email?
Sending email requires a "push" protocol to send messages to the recipient's mail service provider. Receiving mail requires a "pull" protocol for the recipient to download messages from the mail service provider.

6) How does SMTP send additional types of objects (other than raw text), since it isn't built to do so?
Multipurpose Internet Mail Extension (MIME) version inclusion in the header information allows the inclusion of additional data types.

7) SMTP is a ____push____ protocol,
IMAP is a ____pull____ protocol,
POP3 is a ____pull____ protocol.

8) What's the difference between the POP3 and IMAP email protocols (from a user's point of view)?
POP3 has two possible modes:
Mode (1) downloads emails to the client, and deletes them from the mail server
Mode (2) downloads emails to the client, but keeps the originals on the mail server.
IMAP displays emails on the client host, but maintains the client's entire email directory structure on the server. It also maintains the client's history (read/unread messages, etc.)