Solutions: Homework week 2

Review questions:

1. The IP address of the destination hosts and the port numbers of the destination socket.
2. You probably use a browser and a mail reader on a daily basis. You may also use an FTP user agent, a Telnet user agent, an audio/video player user agent (such as a Real Networks player), an instant messaging agent, a P2P file-sharing agent, etc.
3. In persistent HTTP without pipelining, the browser first waits to receive a HTTP response from the server before issuing a new HTTP request. In persistent HTTP with pipelining, the browser issues requests as soon as it has a need to do so, without waiting for response messages from the server.
4. A host's authoritative name server provides the "official" translation of a hostname to an IP address (among other things). A host's local name server is a proxy to the DNS system: the host first queries its local name server for a mapping; the local name server then obtains the mapping on the behalf of the querying host.
5. Web caching can bring the desired content "closer" to the user, perhaps to the same LAN to which the user's host is connected. Web caching can reduce the delay for all objects, even objects that are not cached, since caching reduces the traffic on links.

Problems:

Problem 1.

Application layer protocols: DNS and HTTP
Transport layer protocols: UDP for DNS; TCP for HTTP

Problem 2.

Persistent connections are discussed in section 8 of RFC 2616 (the real goal of this question was to get you to retrieve and read an RFC). Sections 8.1.2 and 8.1.2.1 of the RFC indicate that either the client or the server can indicate to the other that it is going to close the persistent connection. It does so by including the including the connection-token "close" in the Connection-header field of the http request/reply.

Problem 3

The total amount of time to get the IP address is

$$RTT_1 + RTT_2 + \cdots + RTT_n .$$

Once the IP address is known, RTT_O elapses to set up the TCP connection and another RTT_O elapses to request and receive the small object. The total response time is

$$2RTT_o + RTT_1 + RTT_2 + \cdots + RTT_n$$

Problem 5

No. Because the link is full duplex, you have 128 kbps in each direction, and the uploading does not interfere with the downloading.

Problem 6

Alice sends her query to at most N neighbors. Each of these neighbors forwards the query to at most M = N-1 neighbors. Each of those neighbors forwards the query to at most M neighbors. Thus the maximum number of query messages is

$N + NM + NM^2 + \ldots + NM^{(K-1)}$
$= N(1 + M + M^2 + \ldots + M^{(K-1)})$
$= N(1-M^K)/(1-M)$
$= N[(N-1)^K - 1]/(N-2)$.