15. (a) This is the first message (indicated by the SYN flag and the sequence number of zero) in an HTTP dialogue (indicated by the use of port 80); the host aldenv111.allegheny.edu is contacting the HTTP server at gaia.cs.umass.edu.
(b) The sender’s physical (MAC) address is d0:67:e1:c0:68:a8.
(c) Since the sequence number is zero and the length is zero, the acknowledgement number will be the sum of these two, namely 0.
(d) The presence of the SYN flag says that this is the first message of a three-way handshake for a TCP connection.
(e) The appropriate response to a SYN message is a message in which the SYN and ACK flags are both set.

16. Transmission delay, propagation delay, queueing delay, processing delay.

17. (a) The server sends an acknowledgement value of 130, the number of the next byte it expects. (It has just received bytes 110, 111, ..., 129.)
(b) After any timeout, the value of cwnd is always reset to 1 MSS, which is this case is 20 bytes.
(c) After any timeout event, the algorithm returns to the “Slow start” state.
(d) The next segment sent will be the one that timed out, namely the one with sequence number 110.

18. (a) A torrent is a collection of peer machines, all of which are trying to distribute/share a particular file.
(b) Chunks are uniform-sized pieces of the file being distributed in a torrent (typical value: 256K bytes).
(c) The tit-for-tat policy says that a peer will give preference to sharing chunks with those neighbors who are sending data to the peer at the highest rate.
(d) A choked peer is a neighbor that has been excluded from receiving chunks.

19. (a) Each host will randomly choose to wait either 0 or 1 time unit before resending the frame.
(b) Each host will randomly choose to wait either 0, 1, 2, or 3 time units before resending the frame.

20. (a) In order to send frames to the router, the user’s machine must determine the MAC address corresponding to the router’s IP address; ARP is used to request this physical address.
(b) Since the Web server knows only about the internet-side IP address of the router, a NAT (Netward Address Translation) router must convert between this external IP address and the client's internal local address. For instance, the NAT table might say that “10.0.0.5, port 12345” corresponds to “123.132.231.001, port 33333” and “10.0.0.5, port 23456” corresponds to “123.132.231.001, port 44444”.

(c) To send a request to the web server (e.g., “cs.allegheny.edu”), DNS is needed to look up the IP address corresponding to that server name.

(d) UDP is used for sending DNS queries and replies.

(e) TCP is used for HTTP requests.