1. Since standards define the format of messages sent or received. protocols need the support of standards so that different devices can communicate via network

2.
(1) 5 layers: ~~communication~~ application layer, transport layer, network layer. link layer, physical layer

(2) principal responsibility:
→ ~~communication~~ application layer: provides the interfaces from the programmes (such as QQ, Wechat) to access the network and communicate with others.
→ transport layer: provides the function that transmite the data between applications end to end. This layer can also do some data segment processing. such as dividing data.
→ network layer: provides the function that transmitts the data between two end-system.
→ link layer: provides the function that communicate data with neighbors
→ physical layer: transmit the data in the form of binary bits.

3. router (路由器): network. link, physical
   link-layer switch (链路层交换机): link. physical.
   host (主机): application, transport. network, link, physical.

4. (a) $d_{prop} = \frac{m}{s}$ (unit: sec)

(b) $d_{trans} = \frac{L}{R}$ (unit: sec)

(c) no processing delay or queueing delay
so $d_{nodal} = d_{prop} + d_{trans} = \frac{m}{s} + \frac{L}{R}$

d. • At time $t = d_{trans}$, the first bit finished the transmission, and it was in the way of propagation.

e. $d_{prop} > d_{trans}$

(d.) At time $t = d_{trans}$, the ~~first~~ last bit finished the transmission, so it was in the way of propagation.

(e.) $d_{prop} > d_{trans}$. When the last bit finishes the transmission, the first bit has not finished yet. It is in the way of propagation.

(f.) $d_{prop} < d_{trans}$. When time $t = d_{trans}$, the first bit has already finished transmission. It has been on Host B.

(g) $S = 2.5 \times 10^8$, $L = 120$ bits, $R = 56$ kbps

so $\dfrac{m}{S} = \dfrac{L}{R} \Rightarrow m = \dfrac{SL}{R} = 535714 m = 535.714 km$.

5. (a) For the case of circuit switching.

$$N = \frac{\cancel{45} L}{R} = \frac{3 Mbps}{150 kbps} = \frac{3 \times 10^6}{1.5 \times 10^5} = 20$$

it can support 20 users.

(b) Since only 10% of time, the probability for the given user is also 10%

(c) for the exactly n users:

$$P = C_{120}^n \times (10\%)^n \times (1 - 10\%)^{120-n} = C_{120}^n \times (\tfrac{1}{10})^n \times (\tfrac{9}{10})^{120-n}.$$

$$= C_{120}^n \times \frac{9^{120-n}}{10^{120}}$$

(d) probability:

$$P_{sum} = \sum_{i=21}^{120} C_{120}^i \times \frac{9^{120-i}}{10^{120}}$$

page 2

Mar 2009

6. Since TCP provides stable and reliable connection. HTTP, SMTP, POP3 run on top of TCP protocol.

7. a. False. Since it should not receive 4 response messages
   b. False. For the same persistent connection, it can only send into 1 destination, so it cannot send 2 distinct web pages
   c. False. For the non-persistent connection, it can only handle one HTTP request message before connection closed.
   d. False. It represents the time of the request being sent.
   e. False.

8. a. URL: on the first line.
      /cs453/index.html
   b. HTTP version: on the first line?
      HTTP/1.1
   c. persistent or not? on the last line?
      Connection: keep-alive → persistent.
   d. IP Address: None.
   e. Browser Type: on the second line?
      User-Agent: Mozilla/5.0 → Firefox Browser.
      Reason: this type message can help different users to handle the same object in different browser.

9. a. success or not: success on the first line
      200 OK. → document found.
      Time of reply provided: on the first line
      Tue, 07 Mar 2008 12:39:45 GMT
   b. last-modified: on the third line?
      Sat, 10 Dec 2005 18:27:46 GMT

c. Bytes: on the 5th line.

   Content - Length: 3874 →3874 bytes

d. First 5 bytes: <!.doc , on the 8th line

   Agree persistant on the 6th line

   Connection: Keep-Alive. → persistent connection.