

# 计算机网络原理 作业2

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《Computer Networks 5th Edition》

第一章: 1, 2, 3, 4, 9, 10, 11, 12, 15, 20, 33

1. 【解答】 The dog can carry 21 gigabytes, or 168 gigabits. Meanwhile, a speed of 18km/hour equals .005 km/sec. That means the time to travel a certain distance  $x$  km requires about  $200x$  seconds ( $x/.005$ ), which yields a data rate of 168/200x Gbps. For values of  $x$  less than 5.6 km, the dog has a higher rate than the communication line.
  - (i) If the dog's speed is doubled, the maximum value of  $x$  is also doubled
  - (ii) If the tap capacity is doubled, the value of  $x$  is also doubled.
  - (iii) If the data rate of the transition line is doubled, value of  $x$  is halved.
2. 【解答】 The LAN model, compared to simply having a big timesharing system, can be grown incrementally. Clients are not limited to the system, but can use different servers. It is cheaper and more reliable, and clients can be far away from the server.
3. 【解答】 Most networks that require transcontinental links may have a high bandwidth, but also high latency as due to the need to travel long distances. On the other hand, most LAN networks that communicate with a computer within the same building would have low bandwidth and low latency.
4. 【解答】 For digital voice and video traffic, a uniform delivery time would be quite important. Having a short delay but large amounts of variability is worse than a larger delay but small variability. For traffic contain sensitive information such as financial transaction, reliability and security are also important characteristics.
6. 【解答】 request/response would both have to travel up and down, thus, the distance traveled would be  $4 \times 40,000$ , or 160,000km. Thus, the propagation delay is  $160,000/300,000$  sec (speed of light) or about 533msec.
9. 【解答】 The probability of collision is  $1 - np(1-p)^{(n-1)} - (1-p)^n$
10. 【解答】 One reasons of using layered protocols is that it breaks up the network design/architecture into smaller and more manageable pieces. Layering also allows for functionality to changed with affecting other layers, either above or below. One disadvantage is that it might have worse performance than networks using a monolithic system.
11. 【解答】 Physical communication only takes place in the lowest layer, not every layer.
12. 【解答】 These two services streams are different in that in a message stream, the network keeps track of message boundaries, while in a byte stream it does not. For example, if one application writes two 1024 bytes into the connection, a message stream would receive two messages. While a byte stream would only obtain one 2048 byte unit. Thus, for a byte stream, we would not know that there was original two messages.
15. 【解答】 Mean number of transmissions would be  $1/(1-p)$
20. 【解答】 It depends on the reliability of the network. If the network is reliable, sending one acknowledgement at the end of the entire transfer saves bandwidth if no packets are lost. On the other hand, if the network is unreliable, meaning that it tends to lose packets, then its better to acknowledge each step separately, so lost packets can be retransmitted.
33. 【解答】 I tried to ping mit.edu and berkeley.edu, and recieved

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Pinging mit.edu [88.221.139.42] with 32 bytes of data:
Reply from 88.221.139.42: bytes=32 time=448ms TTL=36
Reply from 88.221.139.42: bytes=32 time=419ms TTL=36
Reply from 88.221.139.42: bytes=32 time=466ms TTL=36
Reply from 88.221.139.42: bytes=32 time=434ms TTL=36

Ping statistics for 88.221.139.42:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 419ms, Maximum = 466ms, Average = 441ms

Pinging berkeley.edu [35.163.72.93] with 32 bytes of data:
Reply from 35.163.72.93: bytes=32 time=338ms TTL=35
Reply from 35.163.72.93: bytes=32 time=326ms TTL=35
Reply from 35.163.72.93: bytes=32 time=332ms TTL=35
Reply from 35.163.72.93: bytes=32 time=340ms TTL=35

Ping statistics for 35.163.72.93:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 326ms, Maximum = 340ms, Average = 334ms

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第二章: 1, 3, 4, 5, 9, 20, 25, 37, 38, 39, 40, 48

1. 【解答】  $a_n = -1/(\pi * n)$ ,  $b_n = 0$ ,  $c = 1$
3. 【解答】 Nyquist theorem, we can sample 12 million times/sec, four level signals provide 2 bits per sample, thus  $12 * 2$ , 24 Mbps can be sent
4. 【解答】 Maximum capacity of 6kbps
5. 【解答】 About 93 dB
9. 【解答】 The Nyquist theorem is a property of mathematics and nothing to do with technology. Thus, the theorem is true for both high-quality single-mode optical fiber and copper wire as well as all other mediums.
20. 【解答】 An oil pipeline and walkie-talkie are half duplex connections, while a river is a simplex connection
25. 【解答】 Minimum bandwidth that is required is 43,600 Hz
37. 【解答】 The 3 networks have the following properties  
 Star: best case = 2, average case = 2, worst case = 2  
 Ring: 1,  $n/4$ ,  $n/2$   
 Full Interconnect 1, 1, 1
38. 【解答】  
 Circuit Switching:  
 circuit is set up when  $t = s$   
 last bit is sent when  $t = s + x/b$   
 message arrives at  $t = s + x/b + kd$   
 Packet Switching  
 last bit is sent when  $t = x/b$

last packet must be retransmitted  $k-1$  times by routers, taking  $p/b$  sec, so the total delay would be  $x/b + (k-1)p/b + kd$ . Packet switching would be faster if  $s > (k-1)p/b$

39. 【解答】  $p = \sqrt{hx/(k-1)}$

40. 【解答】 Only three unique cells are needed and each cell can have 280 frequencies

48. 【解答】 A digit PCM needs 64 kbps. Dividing 10 Gbps by 64kbps, we get 156,250 houses per cable.