MAC Layer

1. Explain the pure ALOHA and discuss the performance in terms of throughput.
2. How slotted ALOHA can improve the performance? Explain mathematically and use diagrams.
3. What are the problems if the available bandwidth of a link is shared in time or frequency? Explain a technique to overcome these issues.
4. A certain population of ALOHA users manages to generate 70 requests/sec. Find the channel load If the time is slotted in units of 50 msec.
5. There are n stations in slotted LAN. Each station attempts to transmit with a probability p in each time slot. What is the probability that ONLY one station transmits in a given time slot?
6. Let us consider that a 128 Kbps pure ALOHA channel is going to be shared among some number of stations. Each station will send a 512 byte frame on average every 5 seconds. What is the maximum number of stations this particular network can support? What if this was a slotted ALOHA channel?
7. Consider a network using the pure ALOHA medium access control protocol, where each frame is of length 1,000 bits. The channel transmission rate is 1 Mbps. The aggregate number of transmissions across all the nodes (including new frame transmissions and retransmitted frames due to collisions) is modelled as a Poisson process with a rate of 1,000 frames per second. Throughput is defined as the average number of frames successfully transmitted per second. Find the throughput of the network. Suppose the round-trip propagation delay for a 10 Mbps Ethernet having 48-bit jamming signal is 46.4 ms. What should be the minimum frame size here?
8. Explain three persistence methods of CSMA when a station finds a busy channel.
9. What is the vulnerable time for CSMA?
10. Explain the CSMA/CD for medium access control.
11. Why is there no need for CSMA/CD in today's Ethernet? Explain it.
12. Why cannot wireless LANs implement CSMA/CD, give three reasons?
13. Explain three strategies of CSMA/CA to avoid collisions on wireless networks.
14. What is a transparent bridge?
15. How is the preamble field different from SFD field in 802.3?
16. Explain how 802.11 utilizes NAV to accomplish collision avoidance.
17. What is the relationship between the slot time and maximum length of the collision domain in Ethernet?
18. Why should an Ethernet frame have a minimum data size, explain it?
19. What happens if there is a collision during the handshaking period in a wireless network?
20. Explain why collision is an issue in random access mechanisms, but not in controlled or channelizing protocols?
21. Describe the use of handshaking in the exposed terminal problem.
22. What is the relationship between the slot time and maximum length of the collision domain in Ethernet? Describe the use of handshaking in the exposed terminal problem.
23. Explain how the hidden terminal problem is handled by 802.11.
24. What is the purpose of GPS?
25. Describe the MAC frame format of 802.3 and 802.11.
26. How is the preamble field different from SFD field in 802.3? Explain how 802.11 utilizes NAV to accomplish collision avoidance.

27. What is the relationship between the slot time and maximum length of the collision domain in Ethernet? Describe the use of handshaking in the exposed terminal problem.
28. Determine the maximum length of the cable (in km) for transmitting data at a rate of 500 Mbps in an Ethernet LAN with frames of size 10,000 bits. Assume the signal speed in the cable to be 2,00,000 km/s.
29. A network has a data transmission bandwidth of 20 X 10^6 bits per second. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 microseconds. Find the minimum size of a frame in the network.
30. The probability of a bit being in error on a particular wireless network is p = 10^{-4}, what is the maximum frame size to ensure that no more than 5% of the frames will be lost?

31. How is hub related to a repeater? Explain the format of the 802.3 MAC frame. Explain two MAC sublayers of IEEE 802.11.
32. Explain the multiple secondary communication in Bluetooth. What are the two types of links between a Bluetooth primary and a secondary.

33. What is the difference between BSS and ESS? Describe the layered architecture of Bluetooth. What is GSM?

34. What are the problems if the available bandwidth of a link is shared in time or frequency? Explain a technique to overcome these issues. 5+5
35. A and B are the only two stations on an Ethernet. Each has a steady queue of frames to send. Both A and B attempt to transmit a frame, collide, and A wins the first backoff race. At the end of this successful transmission by A, both A and B attempt to transmit and collide. What is the probability that A wins the second backoff race? A 2 km long broadcast LAN has 10^7 bps bandwidth and uses CSMA/CD. The signal travels along the wire at 2×10^8 m/s. What is the minimum packet size that can be used on this network?
36. Consider a simplified time slotted MAC protocol, where each host always has data to send and transmits with probability p = 0.2 in every slot. There is no backoff and one frame can be transmitted in one slot. If more than one host transmits in the same slot, then the transmissions are unsuccessful due to collision. What is the maximum number of hosts which this protocol can support, if each host has to be provided a minimum throughput of 0.16 frames per time slot? There are n stations in slotted LAN. Each station attempts to transmit with a probability *p* in each time slot. What is the probability that ONLY one station transmits in a given time slot?

37. A network with CSMA/CD protocol in the MAC layer is running at 1 Gbps over a 1 km cable with no repeaters. The signal speed in the cable is 2 x 10^8 m/sec. What should be the minimum frame size for this network?
38. Assume that the round-trip propagation delay for a 100 Mbps Ethernet having 48-bit jamming signal is 46.4 ms. What should be the minimum frame size here?

Network Layer

39. Explain the Routing Information Protocol. What are its main shortcomings? How these issues are handled.
40. Explain the main steps of path vector routing. What is the optimum path in path vector routing?
41. Why is mapping of physical to logical address required? Discuss two limitations of static configuration protocols. Explain how to address these limitations.
42. Explain the DHCP protocol with a suitable interaction diagram.
43. What are the common fields in a routing table? Explain them.
44. Explain the border gateway protocol. What is a session in BGP? What are two types of sessions used here?
45. Explain the Open Shortest Path First protocol. What are the different types of links used in OSPF?
46. Explain two node and three node instability scenarios in distance vector routing. Discuss the strategies to address these issues.
47. Which problem is solved by address aggregation? Explain with a suitable example.
48. What do you mean by name address resolution? Explain the design and main steps of Resolver. Explain the concept of recursive resolution with a suitable example.
49. Discuss the IPV4 datagram format with a suitable diagram. Name three strategies for transition from IPV4 to IPV6 and explain them.
50. Explain the concept of longest mask matching with an example.
51. Explain the distance vector routing. What is a session in BGP? What are two types of sessions used here?
52. What is the purpose of including the IPV4 header and the first 8 bytes of datagram data in the error reporting ICMPV4 messages? Why is there a restriction on the generation of an ICMPV4 message in response to a failed ICMPV4 error message?
53. Assume the sender prepared an IPV4 packet, the value of HLEN is 1000 in binary. How many options are being carried by this packet? Assume that the receiver received the IPV4 packet. And it has arrived with the first 8 bits as 01000010. Now explain what the receiver will do with that packet. Will it be accepted or discarded? Explain your answer.
54. An ISP has a block of 1024 addresses. Assume it needs to divide the addresses among 1024 customers. Does it need subnetting? Explain your answer. Assume an organization is granted the block 211.17.180.0/24. The administrator wants to create 32 subnets. Answer the following: i) Find the subnet mask ii) Find the number of addresses in each subnet iii) Find the first and last address in subnet 1. iv) Find the first and last address in subnet 32. v) Find the range of addresses in the given block.
55. Describe the IPV4 packet format. Suppose 12 bytes of options are present in an IPV4 packet. If (0028)16 is the value of the total length field then find the payload in the datagram. Assume that data i.e., payload size of a datagram is 7221 bytes. If the byte number starts from 0, the 1st fragment transmits the bytes numbered from 0 to 1399. Find the offset value of the 3rd fragment.
56. Explain the address translation mechanism for outgoing packets and packets coming from the Internet? Explain how a router finds the network address to route the packet in following two cases: a) A router outside the department of CSE receives a packet with destination address 190.240.7.91

b) A router inside the department of CSE receives the same packet with destination address 190.240.33.91. Discuss what happens if this destination does not exist in these two cases.

57. What is the mask in IPV4 addressing? What is a default mask in IPV4 addressing? Assume an organization is granted the block 16.0.0.0/8. The administrator wants to create 500 fixed length subnets. Answer the following: i) Find the subnet mask ii) Find the number of addresses in each subnet iii) Find the first and last address in subnet 1. iv) Find the first and last address in subnet 500. v) Find the range of addresses in the given block.

Transport Layer

58. Describe the three-way handshaking for connection establishment in TCP. How TCP handles out-of-order segments?
59. Why is UDP a suitable protocol for multicasting? Why FTP cannot use UDP, but Trivial FTP can use it? Explain the flow control and error control mechanisms of TCP.
60. What is the value of the receiver window (rwnd) for host A if the receiver host B has a buffer size of 14000 bytes and 2000 bytes of received and unprocessed data? What is the size of the window for host A if the value of the congestion window (cwnd) is 10000 bytes.
61. A TCP connection is using a window size of host A, and the previous acknowledgement number was 22001. It receives a segment with acknowledgement number 24001 and window size advertisement of 12000. Draw a diagram to show the situation of the window before and after.
62. Describe the user datagram format. Why does UDP provide connectionless services? Explain the File transfer protocol with socket.
63. Describe the three-way handshaking for connection establishment in TCP. How TCP handles out-of-order segments? A client has a packet of 69000 bytes. Show how this packet can be transferred by using only one UDP user datagram.
64. Discuss the TCP header format with a suitable diagram. Assume 05320017 00000001 00000000 500207FF 00000000 is a dump of a TCP Header in hexadecimal format. Answer the following: i) Find the source port number and destination port number ii) What is the sequence number? iii) What is the acknowledgement number iv) What is the type of the segment? v) What is the window size?

Application Layer

65. Explain the use of NVT in TELNET.
66. Explain the Simple mail transfer protocol.
67. Why is a connection establishment for mail transfer needed if TCP has already established a connection? Why do we need POP3 or IMAP4 for email?
68. Explain the FTP with a suitable diagram.
69. Explain the DNS application with a suitable diagram.
70. TCP or UDP? How to decide for FTP/DNS/DHCP etc applications.