ETSF10, ETSF05

Ht 2010

Example questions for the Final Exam, part A

1. In AdHoc routing there are two main strategies, reactive and proactive routing. Describe in a small number of words the concept of proactive routing. Also describe on advantage and one disadvantage with proactive routing.

2. In AdHoc routing there are two main strategies, reactive and proactive routing. Describe in a small number of words the concept of reactive routing. Also describe on advantage and one disadvantage with reactive routing.

3. In AdHoc networks we have some special considerations, compared with "normal" routing. Discuss shortly why power consumption and forwarding capacity are issues for AdHoc networks.

4. A router has two main objectives. Which?

5. Why must a router be able to understand and handle both the physical, link and network layer?

6. A router introduces delay. Which parts or functions of the router are the main contributors to delay? Why are these parts or functions needed?

7. Describe briefly the three packet switching techniques found in routers: switching via memory, switching via bus and switching via crossbar.

8. Even a local host with only one interface has to perform a rudimentary form of routing. Why? (Tip: It has to do with ARP.)

9. It is true to say "Good news travel fast and bad news travel slow" when you discuss native distance vector routing. Explain briefly why. (Tip: Think of how the update algoritm handles missing links.)

10. Distance vector routing can be described as "global information distributed locally". In short words, using this saying as base, describe the basic route distribution function of distance vector routing.

11. Link state routing can be described as "local information distributed globally". In short words, using this saying as base, describe the basic route distribution function of link state routing.

12. Describe the main steps in link state routing. (Hints: neighbour, link state, link state advertisement, link state database, shortest path first, routing table)

13. What is the objective of a routing table and a forwarding table in a router?

14. In a IP based network, can a forwarding table have two entries with the same destination address? Explain.

15. Could it be beneficial in ip routing to allow for two entries in the forwarding table with the same destination network id if the path cost is equal for the two entries? Explain. (Tip: If yes, how could I be used?)

16. Given this forwarding table in:

Net id	Cost	Next hop
130.235.0.0/16	5	81.12.32.4
191.231.194.0/24	2	129.100.1.1
84.24.0.0/22	1	181.14.62.5
100.100.12.40/27	3	4.235.17.9
191.231.194.0/26	1	73.32.56.123
0.0.0.0/0	1	112.123.89.1

What is the next hop for these destination addresses?
a) 130.235.128.100
b) 138.45.73.123
c) 100.100.12.234
Shortly motivate your answers.

17. Given this forwarding table in:

Net id	Cost	Next hop
130.235.0.0/16	5	81.12.32.4
191.231.194.0/24	2	129.100.1.1
84.24.0.0/22	1	181.14.62.5
100.100.12.40/27	3	4.235.17.9
191.231.194.0/26	2	73.32.56.123
0.0.0.0/0	1	112.123.89.1

What is the next hop for these destination addresses?
a) 84.27.123.21
b) 191.231.194.12
c) 100.100.12.47
Shortly motivate your answers.

18. How many host ids does these network ids contain?
a) 130.235.0.0/16
b) 84.24.0.0/22
c) 100.100.12.40/27
Shortly motivate your answers.

19. Router X has this routing table:
Net Hops Router

Net2 6 A
Net3 4 C
Net4 3 A
Net6 2 C
Net7 3 B
It receives this distance vector update from neighbour C:
Net Hops
Net2 3
Net4 5
Net5 2
Net6 1
Net7 4
What is the new routing table X will use and advertice after update? Motivate each answer.
Router X has this routing table:
Net Hops Router
Net2 6 A
Net3 4 C
Net4 3 A
Net6 2 C
Net7 3 B
It receives this distance vector update from neighbour C:
Net Hops
Net1 2
Net2 3
Net3 16
Net4 5
Net6 4
Net7 4
What is the new routing table X will use and advertice after update? Motivate each answer.

20. A router has this routing table:

Network id	Net mask
10.0.4.192	255.255.255.192
10.0.0.128	255.255.255.128
10.0.0.0	255.255.255.128
10.0.1.0	255.255.255.0
10.0.5.0	255.255.255.0
10.0.6.0	255.255.255.0
10.0.4.0	255.255.255.0
10.0.10.0	255.255.255.0
10.0.2.0	255.255.254.0
10.0.8.0	255.255.254.0

Aggregate as much as possible without the router advertising routes not known to it.

21. In a forwarding table the following entries are found:
191.67.13.0/26 next hop 15.14.13.12
191.67.13.0/24 next hop 12.13.14.15

Is there a problem? Explain.

22. In a forwarding table the following entries are found:
191.67.13.0/26 next hop 15.14.13.12
191.67.13.0/24 next hop 12.13.14.15
How many hosts can be allocated in the larger of the two networks? And how many in the smaller. Motivate your answer.

23. What is the difference between direct delivery and indirect delivery?

24. Give a brief description of the three forwarding techniques next-hop method, network-specific method and default method.

25. In RIP how long time does it take in worst case before a network or a link is declared down by the whole RIP domain? (Tip: Why has infinity been defined?)

26. The so called two node instability problem in RIP can be solved with Split Horizon. How? What is split horizon?

27. The so called three-node instability problem in RIP cannot be solved with Split Horizon. Why?

28. In OSPF four different link types are defined. What is a stub link? What is a point-to-point link?

29. In OSPF four different link types are defined. What is a transient link? Why the need for a so called designated router?

30. Areas are a vital function in OSPF. How are Link State Advertisements distributed inside an area?

31. Areas are a vital function in OSPF. How are Link State Advertisements distributed between areas?

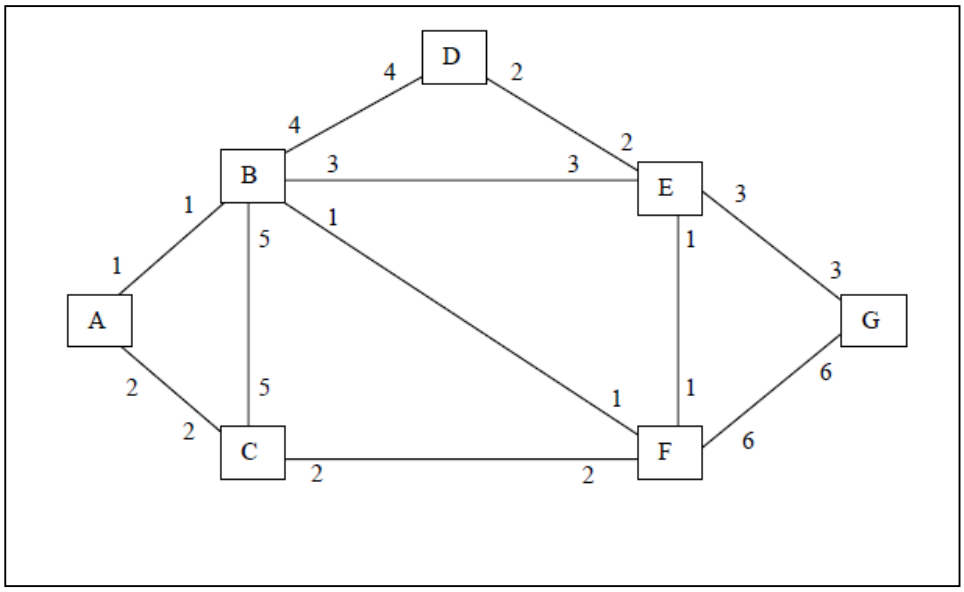
32. Given the network in Figure 1. Calculate the Shortest Path First tree for node D, and build the corresponding routing table from the resulting tree. Answer with the routing table.

33. Given the network in Figure 1. Calculate the Shortest Path First tree for node A, and build the corresponding routing table from the resulting tree. Answer with the routing table.

34. Explain how routing information loops are prevented in e-BGP.

35. How are router neighbours defined in RIP, OSPF and BGP.

36. BGP is a so called path vector protocol. What information is held in the path? How is the path vector used in each router.



37. What is the main difference between e-BGP and i-BGP?

38. Explain why multihoming (multihoming is when a network is connected to two or more upstream ISPs) is a problem for effective route aggregation.

39. Between ISPs with multiple connections to each other we often use so called Hot Potato Routing. What is the objective of this type of Hot Potato Routing?

40. Between ISPs with multiple connections to each other we often use so called Hot Potato Routing. There is a negative(?) side effect with this type of Hot Potato Routing. Which is this, and why could it be negative?

41. What is the main objective for an intra domain routing protocol? And what is the main objective for an inter domain routing protocol? Discuss in e few sentences.

42. Describe shortly the BGP route handling process.

43. Why do OSPF messages propagate faster than RIP messages?

44. What is the network id of the following ip addresses?
130.235.128.100
191.67.23.43
12.13.14.15
127.0.0.1
129.0.0.1
221.3.12.14
Motivate your answers.

45. What is the network id of the following ip addresses?
130.235.128.100/18
192.67.23.43/255.255.128.0

12.13.14.15/24
127.0.0.1/8
129.0.0.1/255.255.255.192
221.3.12.14/255.255.252.0
Motivate your answers

46. In a TCP session, the receiver window size is 1000 and the congestion window size is 750. What is the current sender window size? Motivate your answer.

47. How is the TCP congestion window size changed in the slow-start phase?

48. How is the TCP congestion window size changed in the congestion-avoidance phase?

49. In TCP, for how long is the congestion window increased if TCP is in the congestion avoidance state?

50. Why is error detection and error correction needed end-to-end in the transport layer in the OSI reference model or TCP/IP suite? Isn't it enough with the error handling performed in the link layer?

51. What could be said about the congestion status on the sending path and the receiving path between two hosts if TCP detects a retransmission time-out (RTO)?

52. What could be said about the congestion status on the sending path and the receiving path between two hosts if TCP receives three duplicate ACKs?

53. How many connections are actually setup between a TCP client and a TCP server at the initial three way hand-shake?

54. Explain briefly the three way hand-shake that initiates a TCP connection. How many segments are sent? Which flags are set in the segments?

55. Explain briefly the three way hand-shake that closes a TCP connection. How many segments are sent? Which flags are set in the segments?

56. What happens if the client in a TCP session wants to close down, but the server has more data to send and needs to close down some time later? How many segments are sent? What flags are set in the segments?

57. Explain briefly why addressing ports is needed in the transport layer. Is it not sufficient to have the host address (IP address) added in the network layer?

58. What is a socket address? What does it identify?

59. In TCP, retransmission time out (RTO) forces change of state and sender window size. How does the value of RTO depend on the current round trip time (RTT)?

60. In TCP, retransmission time out (RTO) forces change of state and sender window size. RTO depends on the current round trip time (RTT)? How is RTT defined?

61. Among the performance characteristics, we find delay and jitter. What is delay? What factors have an impact on delay?

62. Among the performance characteristics we find delay and jitter. What is jitter? What type of applications suffer most from jitter?

63. It takes approximately 50 ms for a datagram to cross the Atlantic. What is the bandwidth-delay product of a 10 Gbps link between Europe and USA's east cost? Motivate your answer.

64. Describe briefly the characteristics of bursty traffic. (Hint: Think of the terms average bit rate, peak bit rate, peak time).

65. Traffic shaping can be done with two different techniques called leaky bucket and token bucket. Describe the characteristics of leaky bucket. In what way can it smooth out bursty traffic?

66. Traffic shaping can be done with two different techniques called leaky bucket and token bucket. Describe the characteristics of token bucket. In what way can it smooth out bursts?

67. Describe in short words the concept of priority queuing.

68. Priority queuing can lead to certain classes of traffic not being serviced at all. Why is this?

69. What is the concept of weighted fair queuing? How does it differ from priority queuing?

70. What is the bandwidth of a channel with a propagation speed of $2x10^8$ m/s, if the length of a bit in this channel equals 10 m? Motivate your answer.

71. What is the total delay for a frame of size 1 million bits that is being sent on a link with 30 routers, each router having a queuing time of 2 ms and processing time of 1 ms. The length of the link is 3 km and the speed of light inside the link is $5x10^7$ m/s. The link has a bandwidth of 20 Mbps. Identify the least and most significant components of the total delay. Motivate your calculations.

72. How many UDP user datagrams are required for transmitting 300KB of data? Motivate your answer.

73. Calculate the efficiency of transmission of 12 bytes of data at UDP level. Show how you calculated it.

74. Calculate the maximum efficiency of transmission of 12 bytes of UDP data at IP level. Show how you calculated it.

75. Calculate the efficiency of transmission of 12 bytes of UDP data at Ethernet MAC level. Assume that there are no option fields used at IP level. Show how you calculated it.

76. Calculate the efficiency of transmission of 22 bytes of UDP data at Ethernet MAC level. Assume that there are no option fields used at IP level. Show how you calculated it.

77. In a TCP connection, the value of cwnd is 3500 and the host has sent 1500 bytes that has not been acknowledged. If we are able to send 2000 more bytes, what can be said about the value of receiver window (rwnd)? Motivate your answer.

78. If the value of the fourth 32 bits of the header of a TCP packet is 701806A4 in hexadecimal format. Calculate the type of the segment, length of the option part and window size. Motivate your answer.

79. TCP is sending data at 32Mbps. If the sequence number starts at 9000 how long does it take until it goes again to zero? (Hint: What dimension has the sequence number in TCP?) Show how you calculated it.

80. A window holds bytes 3000 to 6000 and the next byte to be sent is 5000. How will the start and end of the window and next byte to be sent change if a single ACK with the acknowledgment number 3300 and window size advertisement of 4200 is received? Motivate your answer.

81. A window holds bytes 3000 to 6100 and the next byte to be sent is 5000. How will the start and end of the window and next byte to be sent change if a segment with 1000 bytes is sent? Motivate your answer.

82. In multicast routing, routers select the next path by performing Reverse Path Forwarding (RPF). Explain in a few words the concept of RPF. Which address in the incoming packet is used as input to RPF?

83. Reverse Path Forwarding (RPF) is often used for securing a network against unicast with spoofed IP source addresses. Explain how it works and why it is profitable.

84. The multicast routing technique Reverse Path Forwarding (RPF) prevents packets from looping. Put in an environment with uplink redundancy (two or more uplink connections from each access network), RPF does not prevent duplicate packets from arriving at the access network. But Reverse Path Broadcasting (RPB) does. Why? Describe RPB.

85. Explain pruning and grafting in Reverse Path Mutlicast (RPM).

86. Protocol Independent Multicast (PIM) comes in two flavours: Sparse Mode (SM) and Dense Mode (DM). Explain the setup phase for a multicast group when using PIM-SM. When is PIM-SM best choice?

87. Protocol Independent Multicast (PIM) comes in two flavours: Sparse Mode (SM) and Dense Mode (DM). Explain the setup phase for a multicast group when using PIM-DM. When is PIM-DM best choice?

88. Protocol Independent Multicast (PIM) is a multicast routing protocol that is protocol independent. But what type of protocols is it independent of?

89. Explain why multicasting is more efficient than sending multiple unicast streams.

90. Multicast routing is about building trees. Two different principles are used: source-based trees and group-shared trees. Explain source-based trees.

91. Multicast routing is about building trees. Two different principles are used: source-based trees and group-shared trees. Explain group-shared trees.

92. Why does TCP need sending and receiving buffers?

93. A server sends segments of 1460 bytes to a receiver. Just after it has sent sequence 19921, it gets the 3rd duplicate ACK from the receiver with the ACK no.17001. What must the sender that is in the congestion avoidance state do next? Why?

94. Why do we have to handle variable bit rate (VBR) and bursty traffic types if constant bit rate (CBR) is the best type in the sense that it is predictable and, thus, easy to handle for the network? (Hint: think of different types of applications.)

95. Why does TCP "start slowly" and not with an arbitrary, large congestion window (cwnd)? (Hint: imagine that every computer did this simultaneously.)

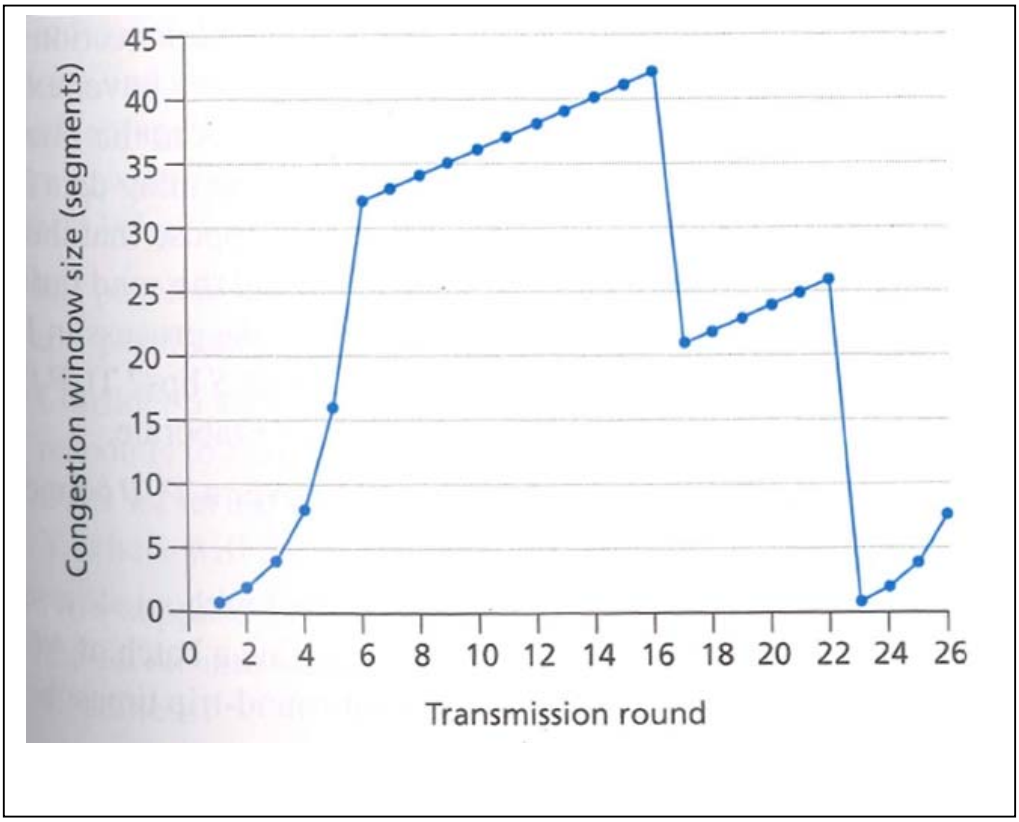
96. Why is there a problem with TCP in wireless networks? (Hint: think of and compare the reasons for packet loss on wireless networks compared with wired networks.)

97. In TCP, the receiver keeps in its buffer the segments coming after a lost segment until the lost segment is received. This is true if for example segments 7 and 8 has arrived OK but segment 6 is still missing. Can you think of any applications which would suffer from this type of operation? Why?

98. A sender transfers a very large file of S bytes to a receiver. TCP is used on the transport layer. What is the maximum value of S such that the sender does not run out of sequence numbers (i.e. the sender does not need to reuse sequence numbers, which is called a sequence number wrap)? Motivate your answer.

99. For the transfer of a file of 4 GB, calculate the transmission time T. The maximum segment size (MSS) is 1460 bytes. Assume 58 bytes of TCP, IP and Ethernet header are added to each segment before the encapsulated frame can be sent out over a 20 Mbps link. Ignore congestion control and flow control in your calculations. Show your calculations.

100. Consider the graph showing the change in TCP congestion window (cwnd) size. Explain what happens between transmission rounds 0 and 10, identifying the corresponding TCP phases and events. Give transmission round, phase and how cwnd values are changed in your answer.



101. Consider the graph in Figure 2 showing the change in TCP congestion window (cwnd)size. Explain what happens between transmission rounds 10 and 20, identifying the corresponding TCP phases and events. Give transmission round, phase and how cwnd values are changed in your answer.

102. Consider the graph in Figure 2 showing the change in TCP congestion window (cwnd)size. Explain what happens between transmission rounds 20 and 26, identifying the corresponding TCP phases and events. Give transmission round, phase and how cwnd values are changed in your answer.

103. UDP is functioning between the best-effort based protocol IP and the processes/applications. So what functionality does UDP contribute with?

104. How can time-stamping and a playout/playback buffer alleviate problems with jitter at the receiver side? What does the technique mean in terms of delay?

105. In what way influences Maximum Transfer Unit (MTU) on the link layer the size of the payload on the network layer?

106. Why is fragmentation needed in IPv4?

107. In IPv4 which network equipment performs fragmentation? And which performs defragmentation?

108. An IPv4 packet includes a TCP segment. The IPv4 packet needs to be fragmented. Which fragments include information from the original IP header? Which fragments include the TCP-header?

109. In IPv6, which network nodes performs fragmentation and defragmentation?

110. Considering which network node that is responsible for fragmentation in IPv6, what knowledge must this IPv6 node have before it can send an IPv6 packet? How does it get this knowledge?

111. In IPv6 the Base Header always has the same size. Why is this beneficial?

112. What identifies an IPv6 flow? Why is it beneficial to identify flows?

113. There are three strategies for transition from IPv4 to IPv6: Dual stack, tunneling and header translation. Give at least one advantage and one disadvantage with dual stack.

114. There are three strategies for transition from IPv4 to IPv6: Dual stack, tunneling and header translation. Give at least one advantage and one disadvantage with tunneling.

115. There are three strategies for transition from IPv4 to IPv6: Dual stack, tunneling and header translation. Give at least one advantage and one disadvantage with header translation.

116. Describe in your own, short words the main objectives of the Internet Control Message Protocol (ICMP).

117. ICPM error reports include the IP header and the first 8 bytes of the payload of the offending IP packet. The IP header is obvious, but why are the first 8 bytes of the payload of interest?

118. Give at least one reason to why it is beneficial for a host to not react on an ICMP redirect message?

119. Which ICMP message or messages are used by the ping application? What information can be extracted from the use of this ICMP message?

120. Which ICMP message or messages are used by the traceroute application? What information can be extracted from the use of traceroute?

121. RTP is a transport layer protocol but RTP still relies on another transport layer protocol. Which? Why?

122. Timestamping and sequence numbers are vital in RTP. For what purposes are time-stampning used?

123. Timestamping and sequence numbers are vital in RTP. For what purposes are sequence numbers used?

124. How can a receiver of a video stream notify the sender of quality issues? RTP/RTPC is assumed.

125. A TV stream experiences problem with synchronization between audio and video right from the beginning. What can be a plausible cause for this? RTP/RTPC is assumed.

126. Which phases of a VoIP telephone call involves SIP?

127. How is an address to person defined in SIP? Hint: What elements are used in a SIP address?

128. What is the objective of a SIP registrar?

129. What is the major objective of the ITU standard H.323?

130. Why is a rely agent needed if the DHCP server is not on the same network as the DHCP client?

131. A DHCP relay agent changes IP addresses in the IP header of the DHCP request. From which addresses to which addresses?

132. The first DHCP reply is (of course?) addressed to the IP address of the DHCP client. But the DHCP client does not know its IP address at this state, and thus cannot be part of an address resolution method. How come the DHCP reply is delivered to the correct client?

133. Which four IP configuration elements are mostly the only content of a DHCP reply. Hint: The elements are the same as any ip host has to be configured with to function on the Internet.

134. A DHCP server offers IP addresses to clients as a lease for 30 minutes. How many times per hour (of continues uptime and connection to the network) has the client to send a DHCP request to the server? Explain why?

135. In what environments is it beneficial to offer IP addresses to clients out of a pool of addresses? Why?

136. Name at least three different types of information you can retrieve from the DNS system.

137. The DNS root servers have knowledge of the name servers for the top level domains. These are divided into three groups of domains. Which are these groups? Give an example of at least one top level zone in each group.

138. The DNS root servers have knowledge of the name servers for the top level domains. These are divided into three groups of domains. In one group there is only one top level zone. Which group is this and what is the name of the top level zone? What is the current

purpose of this domain?

139. Explain in your own words what a zone in DNS is.

140. Explain in your own words what a domain in DNS is.

141. A DNS client requests resolving of a DNS name using recursive resolution. How many DNS request does it have to send? Motivate you answer.

142. A DNS client requests resolving of a DNS name using iterative resolution. How many DNS request does it have to send? Motivate you answer.

143. Which of the two DNS resolution methods, iterative or recursive, can benefit from caching the most? Motivate your answer.

144. What problem does Dynamic DNS solve?

145. Explain in your own words the objectives of payload encryption (goal: one sentence) and message authentication (goal: one sentence).

146. IP Security (IPsec) has two modes, tunneling mode and transport mode. Describe a case when transport mode could be used.

147. IP security has two modes, tunneling mode and transport mode. Describe a case when tunnel mode could be used.

148. In asymmetric encryption each person has two keys, a public key and a private key. Who uses which key for which purpose?

149. In symmetric encryption both the sender and the receiver use the same key. Is there a problem with this approach? Explain.

150. In which layer of the TCP/IP reference model do you place SSL/TLS?

151. An IPv4 datagram of 1500 bytes (header length 20 bytes) arrives through an Ethernet link at an intermediate router. The next link is X.25, which only allows datagrams of up to 576 bytes. How many fragments are created to carry forward the original datagram? What is the offset and total length of each fragment?

152. Why do you think (IPv4) fragmentation may occur at the source or any intermediate router, whereas defragmentation is left to the destination node? Why not defragment a datagram as soon as the bottleneck condition which caused the fragmentation is over?

153. Give, in your own words, an example of a situation in which a host would never receive a redirection message.

154. What is the minimum size of an ICMPv4 error reporting message? What is the content of this message(which headers and how many bytes)? What is the size of the IP packet carrying it?

155. Using Figure 29.16 (p.914) and Figure 29.17 (p. 915) in Forouzan's book, give the amount of data (i.e. how many seconds of interactive audio/video there is) in the playback buffer at the following times: (i) 00:00:05 – (ii) 00:00:13 – (iii) 00:00:26.