

EE 706: Communication Networks

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Code A

Quiz 4 : **20 points** (60 min)

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0. Write down the code of your question paper next to your roll number. [0 points]
1. Four sources A, B, C, D collide in a Ethernet LAN while trying to transmit. They set their binary exponential backoff (BEB) windows to $\{0, 1\}$ at $t = 0$ i.e. the first collision before BEB starts is completed at $t = 0$. Suppose that the slot duration is one second. Suppose at $t = 4$ seconds, the BEB windows of A and B are $\{0, 1, 2, \dots, 15\}$ and the BEB windows of C and D are $\{0, 1, 2, \dots, 7\}$. Give an example of the random numbers picked by the sources which resulted in these BEB windows. Draw a figure illustrating the collision sequence. [5 points]
2. (a) Calculate the Internet checksum of the following bits which are given in hexadecimal format: 80000000 AAAA0000 0000CCDD. [2 points]
(b) A router receives an IP packet and finds from the destination IP address that the intended destination is on a network which is directly connected to one of its network interfaces. What is the protocol used by the router to find the MAC address of the destination node? [1 point]
(c) A system administrator wants to configure a network such that nodes get assigned IP addresses automatically from a given range of IP addresses when they boot up or connect to the network for the first time. What is the name of the protocol which enables this? [1 point]
(d) An ISP assigns a single IP address to a customer who wants to connect to the Internet from his home. The customer has two PCs and a laptop which may connect to the Internet at the same time through a single DSL router. What is the protocol used to share the single IP address among the three local computers? [1 point]
3. Suppose 1520 byte IPv4 datagram which has 1500 bytes of data and 20 bytes of header arrives at a router. It needs to be forwarded along a link which has an MTU of 400 bytes. So the router decides to do fragmentation. Write down the number of fragments sent, the number of bytes in each fragment, the specific bytes contained in each fragment (assuming the original data bytes are numbered 1 to 1500), the value of the IPv4 offset field in each fragment's header, and the value of the IPv4 MF flag in each fragment's header. [5 points]
4. For an offered load of G frames per frame transmission time, the throughput of the ALOHA protocol is Ge^{-2G} and the throughput of the slotted ALOHA protocol is Ge^{-G} . Prove that the maximum throughput of the slotted ALOHA protocol is twice the maximum throughput of the ALOHA protocol. [5 points]