CS358 Computer Networks

Indian Institute of Technology, Patna
End Semester Examination
April 25, 2018 Time: 3 hours FM:80

Instructions: *Read the questions carefully and answer all of them. For the subjective questions, be very precise in your answers. For the problems show the steps clearly.*

1. (a) State the difference between routing and forwarding. Further state the challenges involved in each of them. (2+3=5)

   (b) Briefly state how packet loss can happen at the input and output ports of the routers. Without using infinite buffers at the input ports, how can they be eliminated. Write separately for input and output ports. (3+3=6)

   (c) State the relative advantages and disadvantages of the bus based switching fabric over memory based switching in routers. Further compare the same between interconnection network and bus based switches. (2+3=5)

   (d) Consider a datagram network using 8 bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table as shown in figure 1. For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range. (4)

Prefix Match	Interface
1	0
11	1
111	2
otherwise	3

Figure 1: Forwarding Table

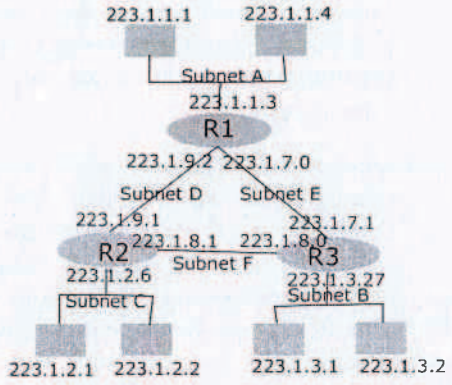

Figure 2: Interconnection of Routers

2. (a) Do routers have IPaddresses? If so how many and why? (1+2=3)

   (b) Justify, whether it is necessary that every autonomous system use the same intra-AS routing algorithm? Why are different inter-AS and intra-AS protocols used in the Internet? (2+2=4)

   (c) Consider three routers, R_1, R_2 and R_3 interconnecting six subnets as shown in figure 2. Assign network address to each of the six subnets, with the following constraints: All addresses must be allocated from 214.97.254/17. Subnet A must have enough addresses to support 250 interfaces; Subnet B and C should have enough address to support 120 interfaces each. Subnets D,E and F should each be able to support two interfaces. For each subnet, the assignment should take the form $a.b.c.d/x$ or $a.b.c.d/x$ — $e.f.g.h/y$. (5)

   (d) State the forwarding table of router R_1. (4)

   (e) Suppose datagrams are limited to 1500 bytes (including header) between source host A and destination host B. Assuming a 20 bytes IP header, how many datagrams would be required to send an MP3 consisting of 4 million bytes. (4)

3. (a) Consider two link layer protocols, one uses single bit parity and the other two dimensional bit parity (calculated using 4 bit blocks). Suppose a bit pattern of 0110-1100-1010-1110 is to

Action	Switch Table State	Link(s) packet is forwarded to	Explanation

Table 1: Table Format

be transferred. What would be the parity bit using each of these protocols? What advantage would the latter provide over the single bit parity mechanism, briefly explain with an example. (1+2+1=4)

(b) A bit stream 10011101 is transmitted using the standard CRC method, using a generator polynomial of $x^3 + 1$. Show the actual bit that would be transmitted. Suppose the third bit from left is inverted during transmission. Will this error be detected at the receiver end, justify. (3+2=5)

(c) How much improvement in efficiency can slotted Aloha generate as compared to the unslotted version (Prove your answer)? Suppose a large population of ALOHA users manages to generate 50 requests/sec, including both originals and retransmissions. Time is slotted in units of 40 msec. What is the expected number of transmission attempts required? (4+3=7).

(d) Is there a specific reason for a minimum frame size requirement in ethernet, explain. For a 10 Mbps Ethernet, if the maximum propagation time (including delays in the device and ignoring time to send a jamming signal) is 25.6μs, what is the minimum frame size of the frame? (2+2=4)

4. (a) Suppose two nodes, A and B are attched to opposite ends of a 900 m cable, and they each have one frame of 1000 bits (including all headers and preambles) to send to each other. Both nodes attempt to transmit at time $t = 0$. Suppose there are four repeaters between A and B, each inserting a 20-bit delay. Assume the transmission rate is 10 Mbps and the CSMA/CD with backoff intervals of multiples of 512 bits is used. After first collision A draws $K = 0$ and B draws $K = 1$ in the exponential backoff protocol. Ignore any jam-signal delay and answer the following: ($1.5 \times 4 = 6$)

   i. Assuming propagation delay to be 2×10^8 m/sec, what is the one way propagation delay (including repeater delays) between A and B in secs.

   ii. When would each of the nodes detect a collision? What would be the reaction of each of the nodes?

   iii. When would A start retransmitting again?

   iv. When would A's packet get completely delivered at B?

   (b) Consider the operation of a learning switch in the context of a network in which 6 nodes labeled A through F are just connected into an Ethernet switch. Consider the following sequence of events (i) B sends a frame to E, (ii) E replies with a frame to B, (iii) A sends a frame to B, (iv) B replies with a frame to A. The switch table is initially empty. Show the state of the switch table before and after each of these events. For each of these events, identify the link(s) on which the transmitted frame will be forwarded, and briefly justify your answers. Please use a table format given in table 1 for your answers. In the *switch table state* column of the table, you need to state the new entries it learns in that step. (4)

5. (a) Can poison reverse completely eliminate the count-to-infinity problem? Give suitable justification to your answer with an example. (1+4=5)

   (b) Can there be two DHCP servers in the same LAN? If no, explain why, else describe how would an address be assigned to a new node in such a situation? (1+4=5)