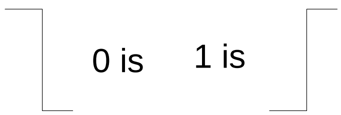
ETS052 Computer Communication: Solutions for exam 2012-10-23

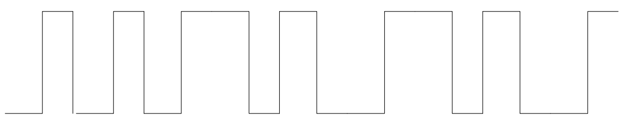
1.

(a) See the book on Link layer control. Hint: Flags

(b) See the book on modulation. Hint: ASK, FSK, and PSK

(c)





(d) See the book on PCM and Telephony. Hint: Telephony uses 4kHz and each sample is encoded with 8 bits.

2.

(a) See the book on local area networks. Hint: In wireless networks, packet collisions are difficult to detect by the senders. Therefore, wireless networks use mechanisms for avoiding collisions and ACKs for ensuring that the sender is informed about successful transmissions.

(b) TDM (TDMA), FDM (FDMA) and CDM (CDMA or DSSS) are described in the book. The terminology is not very clear, but the concepts are the same.

(c) See the book. Hint: What happens when several hosts are connected to the same shared medium?

(d) One advantage with Token passing is that the capacity of the link is shared equally between the hosts. Also, all the capacity can be used, since there are no packet collisions. A disadvantage is that the system needs configuration, and all hosts need to know where to send the token. Also, if a token is lost, or if one host drops out, the system crashes unless there are recover mechanisms.

3.

(a) FFDE:0000:0000:0000:B0FF:0000:0000:FFF0

(b) Descriptions of each protocol are found in the book. Note: ARP is usually placed between the link layer and the network layer, since it maps IP addresses to MAC addresses.

(c) The application WWW is described in the book. The three main parts of WWW are *HTML* for creating web pages, *URL* for specifying the location of web pages, and *HTTP* which is the application protocol used when requesting web pages.

(d) Message integrity is described in the book, in the chapter on security.

4.

(a) (i) The hub will forward the packet on all ports (1, 3, 4) since it works on the physical layer.

(ii) The switch knows A's MAC address from the previous packet, and it will therefore only forward the packet on port 1.

(iii) The router only forwards packets to the correct subnet (port 1), since it looks at the IP address of the destination.

(b) (i) The same as above, the hub forwards all packets on all ports (2,3,4).

(ii) ARP requests are sent with link layer broadcast, which means that the switch forwards the packet on all ports (2,3,4).

(iii) A router terminates a subnet, which means that it will not forward an ARP request.

(c) (a)(i) only concerns the physical layer which means that no IP addresses are involved.

(a)(ii) only needs MAC addresses since it involves the link layer.

(a)(iii) needs IP addresses, otherwise the router cannot forward the packet.

(b) The ARP request needs IP addresses, since the function of the protocol is to map IP addresses to MAC addresses. However, the gizmo may not need IP addresses (the same as above)

5. (a)

(i) $C(x) = x^3+x+1$ (k=3), and $M(x)=x^9+x^7+x^4+x^3+x$ => $B(x)=x^{12}+x^{10}+x^7+x^6+x^4$

The remain R(x) of the division B(x)/C(x) determines the CRC => $R(x) = x^2+x$ => CRC = 110

The message P(x) = 1010011010110 is sent.

(ii) The receiver checks the division P(x)/C(x). If the remain R(x) = 0, the message is assumed to be correct. Any sequence in which a multiple of C(x) is added or subtracted will be assumed to be correct, since $(P(x)+C(x))/C(x) = P(x)/C(x) + a*C(x)/C(x)$ has the remain 0.
Examples: 1010011000000 or 1010011001011 .

(b) Because it helps with distinguishing between old, repeated frames (duplicates) and new ones. Sequence numbers outside outside the window is like a safety zone.

(c)

(i) 6 data packets and 5 ACKs (more details will be added)

(ii) 5+3 data packets and 7 ACKs (more details will be added)

(d) Frame size = 474+26 bytes

Transmission time = $500*8/10*10^6$ seconds = $4*10^{-4}$ seconds

Propagation time = $500/2*10^8$ seconds = $2.5*10^{-6}$ seconds

Number of frames on link = Propagation time / Transmission time = $0.625*10^{-2}$

6. (a)

(i)The Type field of the Ethernet frame header is $86dd_{16}$ which indicates that the frame contains an IPv6 datagram. The same can be found in the four first bits of the IP header, which has the value 6.

(ii) The field Payload length in the IPv6 header has the value 28_{16}, which translates to a payload length of 40 bytes. The IPv6 header is 40 bytes, so the total length of the IPv6 datagram is 80 bytes.

(iii) The destination address is found in the IPv6 header, which in this case has the value 2001:16D8:CC3A:0BF6:D491:66C2:CFC2:0271

(iv) The field Hop Limit in the IPv6 header has the value $80_{16}=128_{10}$. The 128^{th} router will drop the datagram.

(b)

(i) 160.184.66.53/28 means that the 28 leftmost bits belong to the netid.
netid = 160.184.66.48
hostid = 0.0.0.5

(ii) 220.220.220.220/30 means that the 30 leftmost bits belong to the netid.
netid = 220.220.220.220
hostid = 0.0.0.0 (ok strange question)

(c)

(i) 2^4 = 16 hosts, from 160.184.66.40 to 160.184.66.63

(ii) 2^2 = 4 hosts, from 220.220.220.220 to 220.220.220.223

7.

(a) There are maximum two subnets, one for each port to the router. In this case, one subnet contains host C, and the other subnet contains hosts A and B, and the DNS server. However, it is of course possible to configure the router so that there is only one subnet.

(b) (*) means MAC broadcast address

From MAC(A) to MAC(*): ARP request(MAC(IP(DNS))?)

From MAC(DNS) to MAC(A): ARP reply(IP(DNS) has MAC(DNS))

From MAC(A),IP(A) to MAC(DNS),IP(DNS): DNS request(What IP=C?)

From MAC(DNS),IP(DNS) to MAC(A),IP(DNS): DNS reply(C has IP(C))

From MAC(A) to MAC(*): ARP request(MAC(IP(Router))?)

From MAC(Router) till MAC(A): ARP reply(IP(Router) has MAC(Router))

From MAC(A),IP(A) till MAC(Router),IP(C): ICMP echo request

b) Only frames with broadcast address (marked with (*) above), all other frames will be dropped by the switch.

8. (a) The update from C after adding the cost to reach C from A via net 2

Net	Cost
1	21
2	2
3	12
4	11
5	7
6	4
7	27

A's new table

Net	Cost	Next hop
1	10	n/a
2	1	n/a
3	5	n/a
4	11	C
5	7	C
6	4	C
7	25	D

(b)Dijkstra:

1. Make A root and permanent
2. Add net 1, 2 and 3 with costs.
3. Make net 2 permanent (least cumulative cost = 1)
4. Add node C (cos from net 2 to node 2 = 0) so same cumulative cost from A.
5. Add net 4 and 6 to C with cumulative cost from A
6. Net 6 has least cumulative cost from A so make net 6 permanent.
7. Add node E.
8. Make E permanent (least cumulative cost = 4)
9. Add net 9 to node E.
10. Net 3 now has least path cost so add neighbor D to net 3.
11. Make D permanent.
12. Add net 5 and 7.
13. The path to net 5 via C and E is the cheapest. Make that instance permanent and discard the one via D.
14. Net 5 has no non-permanent neighbours.
15. Net 1 now has least path cost so make permanent and add B.
16. Make B permanent and add net 4.
17. The path to net 4 via C is cheapest so make permanent and discard path via B. Net 4 have no non-permanent neighbours.
18. Make net 7 permanent and add F. Make F permanent. Finished.

A's routing table

Net	Cost	Next hop
1	10	n/a
2	1	n/a
3	5	n/a
4	11	C
5	7	C
6	4	C
7	25	D