Assignment 5 Solutions

Question 1

The Ethernet header consists of three values: destination and source address of 6 bytes each and a type/length field of 2 bytes. The destination address, in hex with the customary punctuation, is:

`52:54:00:12:35:02`

the source address is

`08:00:27:18:68:48`

and the Ethertype is:

`0800`

which is the Ethertype for IP so the Ethernet payload must be an IP packet.

Question 2

According to the lecture notes the advantages of a bus compared to a star topology are simple deployment because only one cable is required and flexibility because devices can be added at any point. Three disadvantages were mentioned: lower capacity, privacy and reliability.

For this application the length of wire is important but capacity and privacy are not. Since the relative importance of the other issues (reliability and flexibility) are not mentioned in the problem we would probably pick a bus topology and make sure the issue of reliability was addressed.

Question 3

10 and 100 Mb/s Ethernet PHYs only need two pairs but Gigabit Ethernet needs four so only the 10 Mb/s and 100 Mb/s Ethernet PHYs could be used.

Question 4

The forwarding of Ethernet frames by a learning bridge depends on the sequence of packets received. The source address of each incoming frame tells the bridge the port on which to send frames for that device. If a device has not been seen before or it is a broadcast address it must be flooded to all of the other devices on the same VLAN.

Table 1 shows how the forwarding table is built up over time with each frame and the output ports for each input frame.

Although the learning bridge knows that A3 is on port 4, A3 is in a different VLAN and the forwarding operation operates independently on different VLANs so the frame gets flooded on VLAN 1.

Question 5

Disabling *any one* of the ports would eliminate loops and leave all the nodes connected thus forming an acyclic spanning tree.

Question 6

Since the MS nybble of the first byte (4) is 4 instead of 6 this is an IPv4 header rather than IPv6 header. The total length of the frame is given by the second 16-bit word in the frame: 0x0028 (40 decimal). The protocol is given by byte 10 (6) which is TCP. The source and destination addresses are given by the fourth and fifth 32-bit words: 0a 00 02 0f (10.0.2.15) and 48 15 5b 1d (72.21.91.29).

Question 7

To compute the IP (1's complement) checksum of the values we add up 16-bit values:

```
  11  <- the carries
 d553
 0000
 0667
 636f
 ----
13f29
```

Destination	Source	Port	Forwarding Table	Output on Port
B	A2	3	A2:3	1,2,3
B	A1	2	A1:2, A2:3	1,2,3
A2	A1	2	A1:2, A2:3	3
B	A3	4	A1:2, A2:3, A3:4 (vlan 2)	4
A3	A2	3	A1:2, A2:3, A3:4 (vlan 2)	1,2,3

Table 1: Solution for Question 4.

The we add the MS 16 bits to the LS 16 bits to get 3f2a (0011 1111 0010 1010) and then invert each bit to get c0d5 (1100 0000 1101 0101) which is the checksum. When the same algorithm is applied at the receiver to the data and the checksum the result is zero indicating no errors.

Question 8

The IP address of 169.254.89.26 is a "link local" IP address that is self-assigned by a host that is unable to get an IP assignment using DHCP.

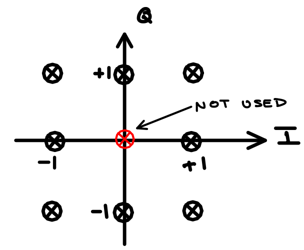
The DHCP server responsible for assigning addresses on this LAN was probably not operational at the time the computer restarted after the power failure. There are many possible reasons for this (e.g. a router that is also the DHCP server was not operational at the time the hosts's networking stack configured itself).

Question 9

An hour is 3600 seconds. At a 1 MHz bit rate the period of the PRBS generator would have to be 3.6×10^3s $\times$ 1×10^6b/s $=$ 3.6×10^9bits. The period of a K-stage PRBS is $2^K - 1$ bits. Solving for K, $K = \log_2 3.6 \times 10^9 \approx 31.7$ Rounding up, we would need K =32 bits of state.

Question 10

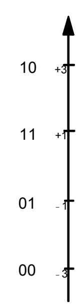
From the equation given in the question, $a(t)$ represents the amplitude of the in-phase (real) component of the carrier and $b(t)$ the quadrature (imaginary) component. Since both $a(t)$ and $b(t)$ can take on values of 0 and ± 1, the constellation diagram would be:



The amplitude of a vector (or the sinusoid represented by a vector) is its length. The center point represents a vector or zero amplitude and would not be used as specified in the question and as shown above. This leaves 8 constellation points which represent the 8 possible transmitted symbols. With 8 symbols we can transmit $\log_2 8 = 3$ bits per symbol.

Question 11

There are several Gray-coded assignments of bits to signal levels for a 4-level baseband signal. The following one is taken from the LS 2 bits of the Q component of the 802.11 16-QAM constellation as shown in the lectures:



Question 12

For MSK or GMSK the frequency deviation must be half of the data rate. For a data rate of 270 kb/s the frequency deviation must be $270/2 = 135$ kHz.