Summer 2018 HW II Solutions

Question 1 (Individual Acknowledgement Protocol)

a) Simply consider the scenario in slide 49 of ReliableDelivery-II.pptx. However, instead of retransmitting too early for frame(3), the sender sends only a single frame (3), but the *channel* duplicates the message (we now how two frame(3)). The reset of the scenario is the same, i.e., the message gets reorder and arrives at the end after the sequence numbers have wrapped around.
b) Make sure that the sequence numbers are large enough so that by the time you wrap around the old copies of the messages are dead.

Question 2 (Switching)

a) Because all information about the source and destination is in the virtual circuit table. The only thing the packet needs to carry is the virtual circuit number, which is a small integer.
b) It is possible to guarantee bandwidth to each source-destination pair. The problem is that routing information about the packet needs to be looked up when the packet arrives, and the fastest way we know how takes O(log n) time, which is slow compared to the O(1) time of virtual circuits.
c) O(1). This is because the routing information is in the virtual circuit table, and this table can be indexed using the VC number inside the header.
d) The table is needed to route the setup message.
e) Determine if a link several hops away is up and routing (maintenance, troubleshooting). Another one could be load balancing of traffic (perhaps some sources sends lots of traffic, and you want them to follow a particular path)

Question 3 (Ethernet Bridges, i.e. switches)

a) every bridge has learned the location (well, the general direction) of x, this is because ARP REQUEST are sent in broadcast mode, so the message goes to all LAN segments, so all bridges hear it

b) note that the ARP REPLY from y to x is sent to the address of x directly, so all bridges know x from a) above, so the message will go directly along the path from y to x. Note also, that if the massage goes thru a segment, then all bridges in that segment will see the message and learn from it. Thus, all bridges, except bridge A will learn the location of Y.

c) note that the ARP REQUEST will be sent in broadcast mode. Hence, ALL bridges will learn about the location of z

Question 4 (Distance Vector Routing)

For the link cost, simply make the following small change to the receive update(c) from g action:

There are two places in the action where we use c[d]+1. Simply replace the 1 by linkCost[g]

Notice that we are using linkCost[g] and not linkCost[d] because the 1 represented the cost of the link to g (assumed to be simply one because we were using hop count as the metric before).

To add split horizon with poison reverse you simply replace the statement

```
send upd(cost) to g
```

for the following for loop

```
for every d do
    if rtb[d] = g then
        c[d] = infinity
    else
        c[d] = cost[d]
    end if
end for
send upd(c) to g
```

Question 5 (Broadcast for link state routing)

The protocol will work (assuming no message losses). After the first flooding by node q, a spanning tree will be created rooted at q. The parent of each node p on this tree is stored in its variable parent[q]. Basically, since any node can do a flooding, there will be N spanning trees, one for every node in the network.

Once the tree of a node is built, e.g. the tree of q, i.e., once parent[q] != nil, then we do not change parents again, and we receive future floods only via the tree. This is fine as long as there is no message loss and no nodes die.

Question 6 (link-state routing)

32 seconds. This is because every node will send out its LSA within 30 seconds and all of these propagate in the network within two seconds. Hence, within 32 seconds everyone has a new copy of the network topology. All nodes run Dijkstra’s algorithm to compute their next hop (assuming this takes only a few moments), and at this point the routing loop is gone.

Question 7 (Ethernet)
Consider slide 22 of the LAN-and-MAC PowerPoint file, where we discussed collision detection. If A sends a small packet (the minimum size) and the round-trip delay is larger than the standard, then A will finish transmission before it hears the packet of

C. In this case, A believes its packet was successfully transmitted, when actually it collided with that of C and is lost.

Question 8 (MACA)

A --- B ----- C --- D

distance(A,B) < r,
distance (C,D) < r,
distance(A,C) < R,
r < distance (B, C) < R

A sends RTS to B,
B sends CTS to A

C does not understand the CTS sent by B (since it is more than r away), so it is just loud noise.

A xmits to B
(note, B is silent now)

C then is unaware of the transmission from A to B, so C can initiate a xmission to D (send RTS to D, and receive CTS from D, then send data to D).

The transmission from C to D will interfere (corrupt) the reception at B of the transmission from A.

Note that if r = R, then C can hear the CTS from B, and decode it, and thus keep silent (not attempt to send to D).

Question 9 (IP Addressing)

a) It should not since the mac address is only used locally in the network. In principle they should be unique globally, but this requirement is stronger than necessary.

b) the IP process will indeed see the message because the Ethernet will pick it up and give it to IP. The TCP process will NOT see this message because IP realizes the destination address is not its own, nor is it an IP broadcast message, and thus it will silently throw it away.

Question 10 (IP configuration)

There are three things that will happen before you can reach the web site

i) the host needs its own information, i.e., DHCP has to be performed. This involves the exchange of messages with the dhcp server as mentioned in the slides.

ii) the host needs to change the name of the web site to an IP address, it will do so via the DNS server. however, to reach the DNS server its has to go through its default router, so via ARP the host finds the Ethernet address of the default router

iii) the host can then send a message to the DNS server (via the default router of course)

finally, you can then send a message directly to the web site (via the default router of course)