Tutorial 6 Solution

1.

From the point of view of the end-to-end argument, retransmission can only be completely and correctly implemented at the end hosts because the source is the only entity that can retransmit everything faithfully. Thus, retransmission at the link layer is only justified if it enhances performance.

Advantage of link layer retransmission for TCP over wireless networks
- Packets need not be retransmitted all the way from the source.
- More responsive retransmission for the destination because link layer detects locally rather than waiting for TCP to timeout at the source.
- TCP does not need to decrease congestion window (thus maintain higher transmission rate) if the lost was due to transmission error at the link layer.

Disadvantage of link layer retransmission for TCP over wireless networks
- Having link layer retransmission increases the RTT of TCP segments. This will result in higher RTO and thus make TCP less responsive to congestion on the network.
- The retransmission scheme (e.g. if selective ARQ is implemented) at the link layer may inadvertently effect the retransmission scheme of Go-Back-N for TCP.
- For higher layer protocols which do not require retransmission (e.g. UDP), having retransmission at the link layer means that there is no flexibility – error checking/correction and retransmission which increase complexity and latency may defeat the goals of some higher layer applications such as VoIP.

2. This question is unfortunately very difficult to answer – to derive the exact solution is extremely complex and time consuming. This is because TCP itself is a very complex protocol involving several variables that are independent yet affect each other. Thus, for this question, it is sufficient for you to work out the solution until you cannot go any further, and appreciate why it is so difficult.

Several of the principles are important for revision of the principles:
- Why do we use RTT and how is it calculated?
- How does a dropped segment effect the RTT calculation?
- How does delayed acknowledgements (ack every second segment) effect the RTT calculation?
- How does timestamps help in determining the RTT?
- Assuming WTCP works perfectly, which of the schemes (normal, delay ack and WTCP) would give you more accurate RTT estimate? (given the same number of segments sent and the same lost characteristic at the wireless link).