Ve489 Computer Networks

Final exam: Session 3

10:50am-11:40am

August 4, 2020

Important Notes:

1. All the exam questions are only used for yourself within this class. You are not allowed to distribute to anyone else or post it anywhere. Otherwise, your behavior will lead to violation of honor code.
2. During the exam, you should follow JI's on-line exam rules.
3. Answer your questions in a word file. Don't forget your name and student ID. Also, each answer must be indexed consistently with the question number.
4. Submit your answer within last 5 minutes of each session, by email to the instructor.

Questions of Session 3 (Total: 50 points):

1. Why a computer network is designed layer by layer? Is layering always good? (3 points)

2. Please write out the well-known equation of Shannon's channel capacity? Define the parameters in your equation. Moreover, explain what role does a channel coding scheme play in this equation? (3 points)

3. Considering an IEEE 802.11 network, usually a MAC data frame is usually about 1500 bytes. (7 points)
    a. If the communication rate is a few Mbps, is it appropriate to use stop-and-wait ARQ protocol? Explain your answer. (2 points)
    b. If the communication rate is tens Gbps, is it appropriate to use stop-and-wait ARQ? Explain your answer. (3 points)
    c. Can we use select repeat ARQ in the problem b? Explain your answer. (2 points)

4. The following questions are about CSMA/CD: (6 points)
    a. Why collision detection (CD) is important to improve the performance of Ethernet? (2 points)
    b. Can a wireless local area network use CD? Explain your answer. (4 points)

5. In the token ring (a distributed polling MAC protocol), suppose the token is lost for some reasons, then the protocol will fail. What can we do we handle such a situation? (3 points)

6. Why does a station need to conduct physical carrier sensing for a DIFS period before it can send data? (3 points)

7. Usually a solution to the hidden-node issue makes the exposed-node issue more severe. Please come with a new scheme that resolve the hidden-node issue without making the exposed-node issue more severe? (5 points)

8. Suppose multiple users in an IEEE 802.11 network want to have different access priorities. Please come up with a scheme to achieve so. (3 points)

9. Considering link state routing, each node determines its own routing path to all other nodes in the entire network. Suppose the routing path is not embedded into an IP packet (to avoid too much overhead), then explain how can the end-to-end routing be conducted efficiently? (3 points)

10. Why is TCP a byte-stream protocol instead of datagram used in UDP? (3 points)

11. How congestion control and flow control are conducted together in TCP? (3 points)

12. The following questions are about TCP slow start: (8 points)
    a. Why is slow start so important? (2 points)
    b. In slow start, the sending rate of TCP segments increases exponentially, but why is it called “slow start”? (3 points)
    c. When can TCP skip low start? In this case, what other mechanisms can TCP use? (3 points)