

Dept. of Computer Science and Engineering, National Sun Yat-sen Univ.
Second Semester of 2018 PhD Qualifying Exam

Subject : Computer Networks

1. There are four sources of the packet delay. Please explain them according to the order of delays while it enters into a node such as a router. For the queueing delay, when the traffic load is larger than 0.9, the queueing delay increases exponentially. Why is it? Please also draw a picture to show the trend of the average queueing delay versus the traffic load from low to high.
2. There are several layers for the Internet protocol stack. Please first draw the Internet protocol stack and then explain the functions of each layer. Then please depict the advantages and disadvantages behind layering.
3. Encapsulation is a method adopted repeatedly in computer networking. What are the advantages of the encapsulation method? Please describe four examples in which the encapsulation method is used. If we do not adopt the encapsulation method, can we or how do we deal with these four examples above by alternative methods?
4. How can we achieve a reliable data transfer under unreliable channel conditions? Please list and explain related techniques used to realize reliable packet transmissions under changing channel conditions.
5. Please draw a picture to explain the operations of TCP congestion control. Slow start phase, congestion avoidance phase, and experiencing a time out or three repeated ACKs must be included in your picture and explanations.
6. There are two methods to structuring network control plane, which is per-router control for traditional method and the other graph is software defined networking. Please draw two graphs for each method and explain the two graphs you draw by your understandings to some details.
7. Please write a pseudo code for Dijkstra's algorithm. Please also give remarks to your codes for easy reading.
8. What is CSMA? What is CSMA/CD? Why is it used in IEEE 802.3 wired Ethernet? Please draw a picture to show the early abort of transmission if a collision is detected along the time by CSMA/CD. What is CSMA/CA? Why is it adopted in IEEE 802.11 wireless networks? Please also draw pictures to explain the hidden terminal problem and the exposed terminal problem in wireless networks?
9. Please draw the architecture of a router, which includes input ports, output ports, processors, and the switching fabric. Please also explain each module and explain input port functions and output port functions, which both consist of three main components. Besides, please also draw a picture to explain the possible Head-Of-Line (HOL) blocking problem within the switching fabric.
10. What is TCP? What is UDP? Why do we need two different transport layer protocols? And why do we need TCP and/or UDP if we already have IP? If you are asked to develop a new protocol to replace these two transport layer protocols, what new characteristics would you suggest to add?