

**Dept. of Computer Science and Engineering, National Sun Yat-sen Univ.**  
**Second Semester of 2020 PhD Qualifying Exam**

Subject : Computer Networks

1. What is packet switching? Please use a table to list the advantages and disadvantages of packet switching. It should include why 4G and 5G networks also switch from circuit switching to packet switching.
2. Internet protocol stack consists of five layers. Open System Interconnection Model (OSI) consists of seven layers. Please explain and compare the functions of each layer of these two models, respectively.
3. Encapsulation is a common approach adopted by networking engineers. Please explain the concept of encapsulation in some detail and list three examples of applying encapsulation in networking.
4. Please use a table to compare TCP and UDP, two Internet transport-protocol services, to the point. Please also describe the TCP congestion control in some detail by drawing a graph of congestion window size versus transmission round, which includes the slow start phase, the congestion avoidance phase, and the condition of experiencing losses.
5. Please write a pseudo-code of TCP socket programming for simple client-server interactions. Please also give remarks to your codes for easy reading.
6. Please depict a picture to explain what is Software Defined Networks (SDN)? What is its difference from traditional routers?
7. Please write the pseudo-code for Dijkstra's algorithm.
8. How is CSMA/CD operated? Why is CSMA/CD adopted for wired networks? What is CSMA/CA and how is it operated? Why is CSMA/CA adopted by wireless networks to avoid the hidden terminal problem? Moreover, what is the hidden terminal problem?
9. There are four sources of packet delay. Please explain them according to the order of delays while it enters into a node such as a router. Please also draw a picture to show the trend of the average queueing delay versus the traffic load from low to high. Note that the delay increases exponentially when the load is around 0.9 or higher. Would you please suggest the reasons behind it?
10. Please draw the architecture of a router, which includes input ports, output ports, processors, and the switching fabric. Please also draw and describe input port function and output port function modules, which both comprise three main components. Besides, please also draw a picture to explain the possible Head-Of-Line (HOL) blocking problem within the switching fabric.