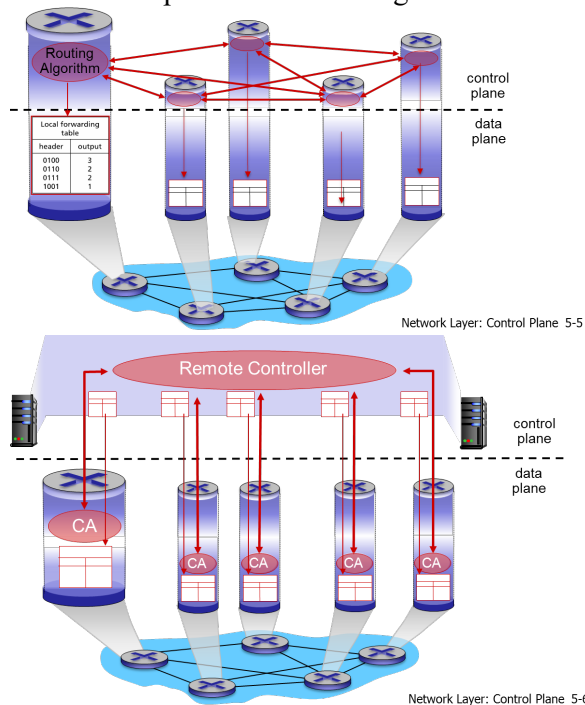**Dept. of Computer Science and Engineering, National Sun Yat-sen Univ.**
Second Semester of 2022 PhD Qualifying

Exam Subject： Computer Networks

1. The Internet protocol stack consists of five layers. What are the advantages and disadvantages of multiple layers? Please also explain the functions of each layer, respectively.

2. Please use a table to compare TCP and UDP, two Internet transport-protocol services, to the point. Your table should include comparisons of if reliable transport, flow control, congestion control, timing, throughput, and connection-oriented are supported. The reasons why there are two protocols should also be included.

3. Draw pictures to explain what are TDMA, FDMA, and slotted ALOHA, respectively?

4. Please draw generic input port functions of a router architecture and explain its operations. What is ARP protocol? Please explain the ARP protocol by giving an example.

5. Please draws pictures to explain weighted fair queueing (WFQ), FIFO scheduling, round-robin scheduling, and priority scheduling, respectively.

6. Encapsulation is a method adopted repeatedly in computer networking. What are the advantages of the encapsulation method? Please draw pictures to explain the operations of encapsulation. Please describe four examples in which the encapsulation method is used.

7. The following two graphs represent traditional routers and SDN routers. Please first explain the operations of traditional routers. Then explain the operations of routers with logically centralized control plane and control agents.

Network Layer: Control Plane 5-5

Network Layer: Control Plane 5-6

8. Please write a pseudo-code of TCP socket programming for simple client-server interactions. Please also give remarks to your codes for easy reading.

9. Please write the pseudo-code for Dijkstra's algorithm and provide some remarks for your code. Then use Figure 1 below to explain how Dijkstra's algorithm works step by step.
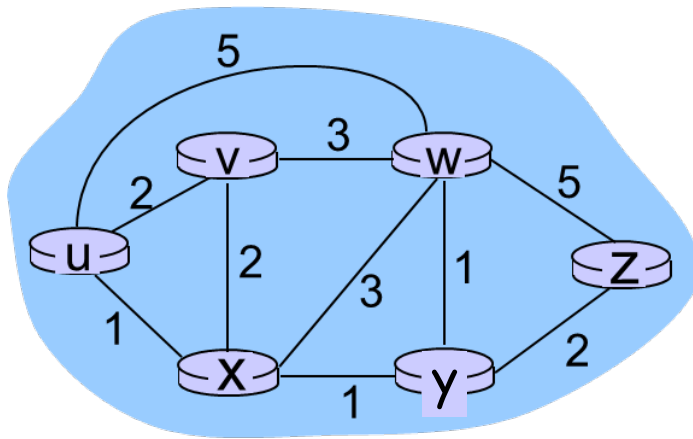
Figure 1. A sample graph.

10. What is Carrier Sense Multiple Access with Collision Detection (CSMA/CD)? Why is CSMA/CD used in IEEE 802.3 wired Ethernet? Please use the following graph to explain how to virtually emulate the CSMA/CD protocol of bus architecture by the star architecture and describe how it works.