**Department of Computer Science and Engineering**
National Sun Yat-sen University
Second Semester of 2023 PhD Qualifying Exam

Subject： Computer Networks

1. What is packet switching? What is circuit switching? Please describe and compare them by your understanding with a table. What is FDMA? What is TDMA?

2. There are four sources of packet delay. Please draw a picture to explain them according to the order a packet encounters while entering a router.

3. 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.

4. What are the advantages of the encapsulation method? Please draw pictures to explain the operations of encapsulation. Encapsulation is an essential methodology for networking. Please give five examples to demonstrate the usage of encapsulation.

5. 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. Why are there two protocols?

6. There are four types of DNS: A, NS, CNAME, and MX. Please give an example to apply these four types and show the needs of four kinds.

7. In video coding, how to save coding rates for video images by spatial coding and temporal coding? Please explain the operations of the client and server sides of Dynamic, Adaptive Streaming over HTTP (DASH). Please include why we can watch videos of different qualities on the client side by adapting to network conditions.

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

9. Please draw pictures explaining weighted fair queueing (WFQ), FIFO, round-robin, random, and priority scheduling.

10. Please write the pseudo code for the select repeat for both the sender and receiver sides. Please explain the selective repeat protocol by depicting the operations of a sender and a receiver in your word.

11. Briefly explain the operations of TCP congestion control by drawing a graph of congestion window size versus transmission round. Your explanation must include the slow start phase, the congestion avoidance phase, and the condition of experiencing losses.

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

Network Layer: Control Plane 5-5

Network Layer: Control Plane 5-6
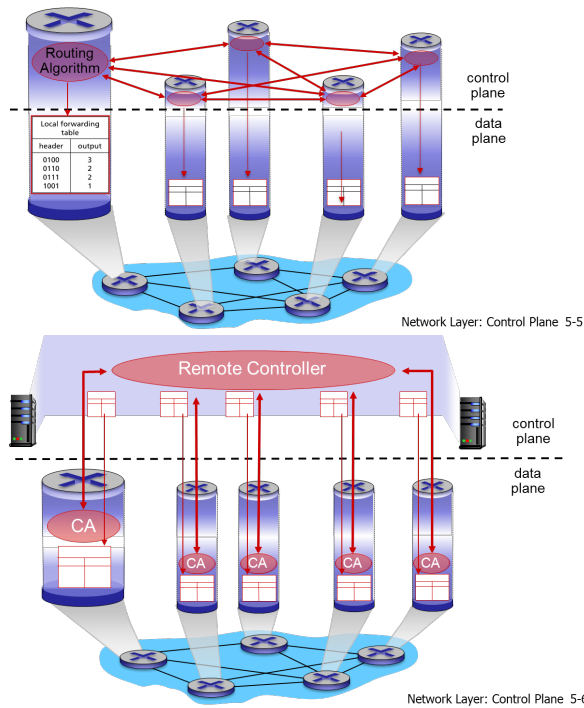
13. Please write the pseudo-code for Dijkstra's algorithm and provide some remarks for your code. Then use Figure 1 below to explain how Dijkstra's algorithm works step by step.
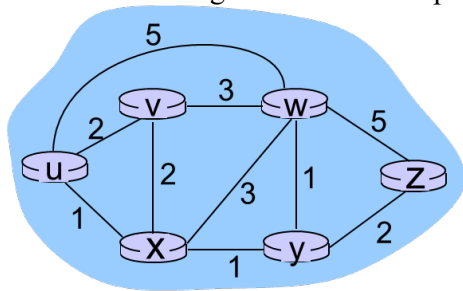

one large datagram becomes several smaller datagrams

14. Please fill in the missing parts of the above graph. The MTU is 1500 bytes.

15. 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.
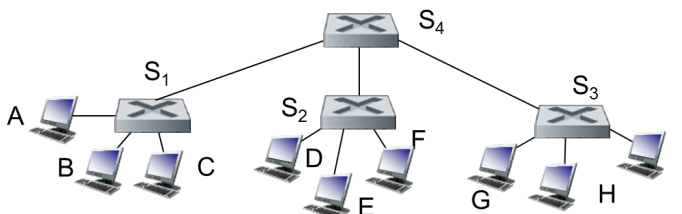
16. Please use the following graph to explain the rule, the action, and the stats of flow table entries. Please also use the graph to illustrate the broad applicability of OpenFlow, which unifies various kinds of devices such as routers, switches, firewalls, NATs, and others.
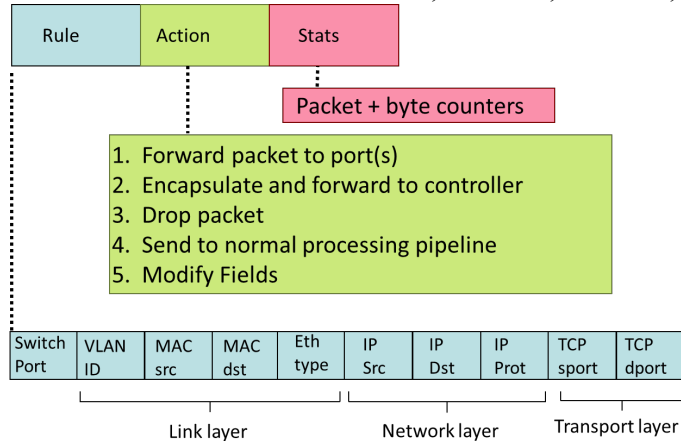
17. Please compare message complexity, robustness, and speed convergence of LS and DV algorithms.

18. What is ARP protocol? Please describe the ARP protocol by giving an example. Please draw signals between a client and a DHCP server to explain how and what an arriving client obtains via the DHCP protocol.
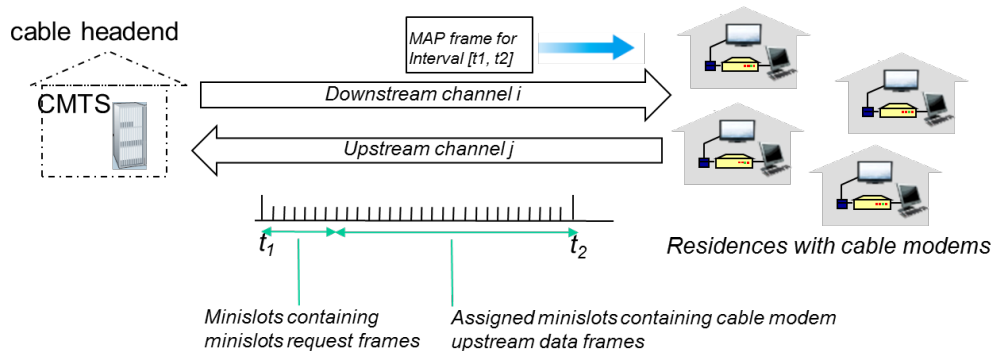
19. Please explain the data over cable service interface spec (DOCSIS) protocol above. Please give your remarks about the size of t_1 and t_2, respectively.

20. Please explain how to implement IEEE 802.1Q VLANs across multiple switches and draw a graph to demonstrate it.