

國立雲林科技大學資訊管理系
111 學年度第 1 學期博士班資格考
科目：資訊網路

時間：4 小時 (Closed book)

作答時，請注意各題之比例配分，並清楚標示題號

第一部分

- 50 分(選答題 3 選 2，每題 25 分)

1. Answer the following questions:

- (a) How big is the MAC address space? The IPv4 address space? The IPv6 address space?
- (b) Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within a frame with a specific destination MAC address?
- (c) Compare the frame structures for 10BASE-T, 100BASE-T, and Gigabit Ethernet. How do they differ?
- (d) It has been said that when IPv6 tunnels through IPv4 routers, IPv6 treats the IPv4 tunnels as link-layer protocols. Do you agree with this statement? Why or why not?
- (e) Suppose you purchase a wireless router and connect it to your cable modem. Also suppose that your ISP dynamically assigns your connected device (that is, your wireless router) one IP address. Also suppose that you have five PCs at home that use 802.11 to wirelessly connect to your wireless router. How are IP addresses assigned to the five PCs? Does the wireless router use NAT? Why or why not?

2. Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgment whenever it receives a segment from Host A.

- (a) In the second segment sent from Host A to B, what are the sequence number, source port number, and destination port number?
 - (b) If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?
 - (c) If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?
 - (d) Suppose the two segments sent by A arrive in order at B. The first acknowledgment is lost and the second acknowledgment arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.
3. (a) Consider Figure 1. Suppose that all links are 100 Mbps. What is the maximum total aggregate throughput that can be achieved among the 9 hosts and 2 servers in this network? You can assume that any host or server can send to any other host or server. Why?
- (b) Suppose the three departmental switches in Figure 1 are replaced by hubs. All links are 100 Mbps. Now answer the questions posed in problem a).
- (c) Suppose that all the switches in Figure 1 are replaced by hubs. All links are 100 Mbps. Now answer the questions posed in problem a).

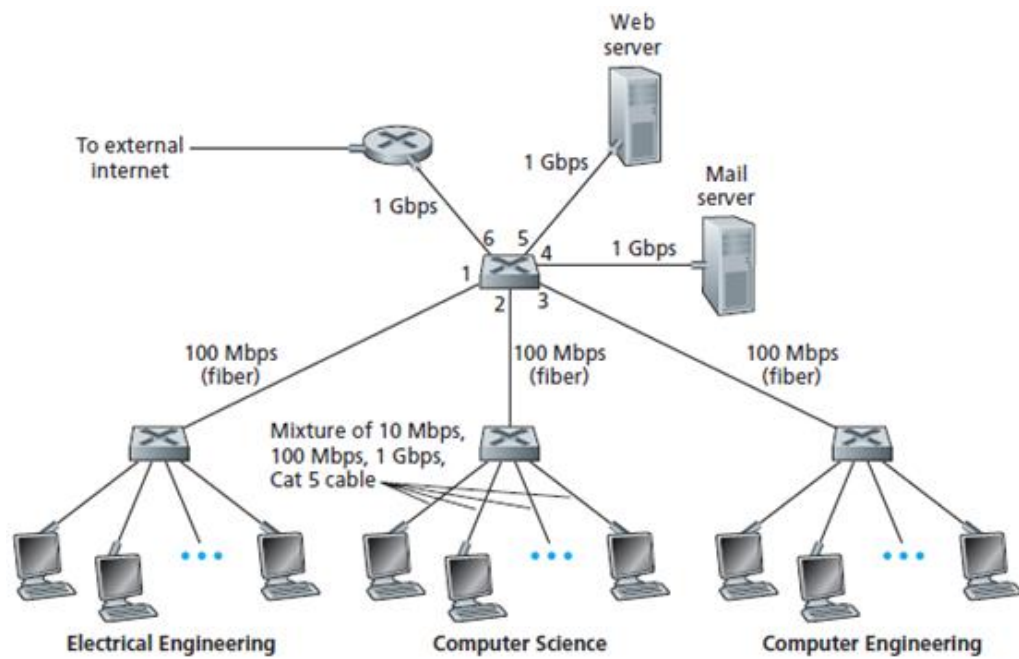


Figure | An institutional network connected together by four switches

第二部分

● 50 分(選答題 7 選 5，每題 10 分)

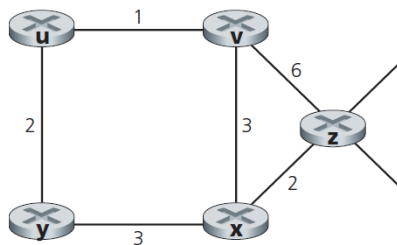
1. Consider sending a large file from a host to another over a TCP connection that has no loss.

a. Suppose TCP uses AIMD for its congestion control without slow start. Assuming increases by 1 MSS every time a batch of ACKs is cwnd received and assuming approximately constant round-trip times, how long does it take for increase from 6 MSS to 12 MSS (assuming no loss cwnd events)?

b. What is the average throughput (in terms of MSS and RTT) for this connection up through time=6 RTT?

2. Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes? Explain how you computed your answer.

3. Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node z.



4. Suppose nodes A, B, and C each attach to the same broadcast LAN (through their adapters). If A sends thousands of IP datagrams to B with each encapsulating frame addressed to the MAC address of B, will C's adapter process these frames? If so, will C's adapter pass the IP datagrams in these frames to the network layer C? How would your answers change if A sends frames with the MAC broadcast address?

5. (a). What is the maximum number of VLANs that can be configured on a switch supporting the 802.1Q protocol? Why?

(b). Suppose that N switches supporting K VLAN groups are to be connected via a trunking protocol. How many ports are needed to connect the switches? Justify your answer.

6. What is the role of the Mobility Management Entity (MME) in 4G/5G cellular architecture? With which other 4G/5G network elements (mobile device, base station, HSS, Serving Gateway Router, PDN Gateway Router) does it directly communicate with in the control plane? In the data plane?
7. Suppose there are two ISPs providing WiFi access in a particular café, with each ISP operating its own AP and having its own IP address block.
- (a). Further suppose that by accident, each ISP has configured its AP to operate over channel 11. Will the 802.11 protocol completely break down in this situation? Discuss what happens when two stations, each associated with a different ISP, attempt to transmit at the same time.
- (b). Now suppose that one AP operates over channel 1 and the other over channel 11. How do your answers change?