Department of Computer Science and Information Engineering
Chang Gung University
Fall 2017 Computer Networks (IT3007)
Final Exam 2018/01/15 15:10-18:00
Suggested Solutions

B042-9030

作答前請務必詳閱下列規定：

1. 除作答需要使用的文具之外，其他物品請放到教室前方，特別是手機與平板電腦等手持裝置，嚴禁帶在身上或是放置在座位上，並請關機或切換至震動模式；否則視為違反考試規則，並視嚴重程度扣分。
2. 請記得於簽到表上簽名後再離開考場。
3. 若使用超過一張答案紙，各頁均須寫上學號與姓名，並於右下角標示頁碼，使用教室前方提供的釘書機裝釘後再交卷。
4. 考試結束請繳回此試卷。

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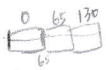
1. (15%) Answer true or false for each of the following statements:
   (a) In link-state routing algorithms, each node needs to communicate with all other nodes (via broadcast), but it tells them only the costs of its directly connected links.
   (b) Distance-vector routing protocols use the Bellman-Ford algorithm to calculate paths. The Bellman-Ford algorithm suffers from the count-to-infinity problem. A technique known as poisoned reverse can be used to completely solve the count-to-infinity problem.
   (c) Channel partitioning protocols can fully utilize the shared media even when only one node has data to send.
   (d) Ethernet is an unreliable link layer protocol. In other words, it does not guarantee to move each network-layer datagram across the link without error.
   (e) The maximum efficiency of the pure ALOHA protocol is higher than that of the slotted ALOHA protocol.

2500
2160
340

2. (10%) Consider sending a 2500-byte datagram into a link that has an MTU of 540 bytes. Suppose the original datagram is stamped with the identification number 456. What are the values in the various fields (*datagram length*, *identifier*, *flag*, and *fragmentation offset*) in the IP datagram(s) generated related to fragmentation?

540-20=520 520/8=65



Datagram	Datagram length	Identifier	Offset	Flag
1	540	456	0	1
2	540	456	65	1
3	540	456	130	1
4	540	456	195	1
5				

65
65
130
150

3. (15%) Ethernet is the most prevalent wired LAN technology.
   (a) (10%) Describe how Ethernet works. Note that you have to describe the binary exponential backoff algorithm in detail.
   (b) (5%) Assume that a sending node detects the fourth collision of a transmitted frame on a 1 Gbps Ethernet. What is the maximum waiting time for the node to retry transmitting the frame?

第4次

4. (10%) Consider the figure shown below. Assuming TCP Reno is the protocol experiencing the behavior shown in the figure, answer the following questions.

(a) (1%) Identify the intervals of time when TCP slow start is operating.

(b) (1%) Identify the intervals of time when TCP congestion avoidance is operating.

(c) (1%) After the 13th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

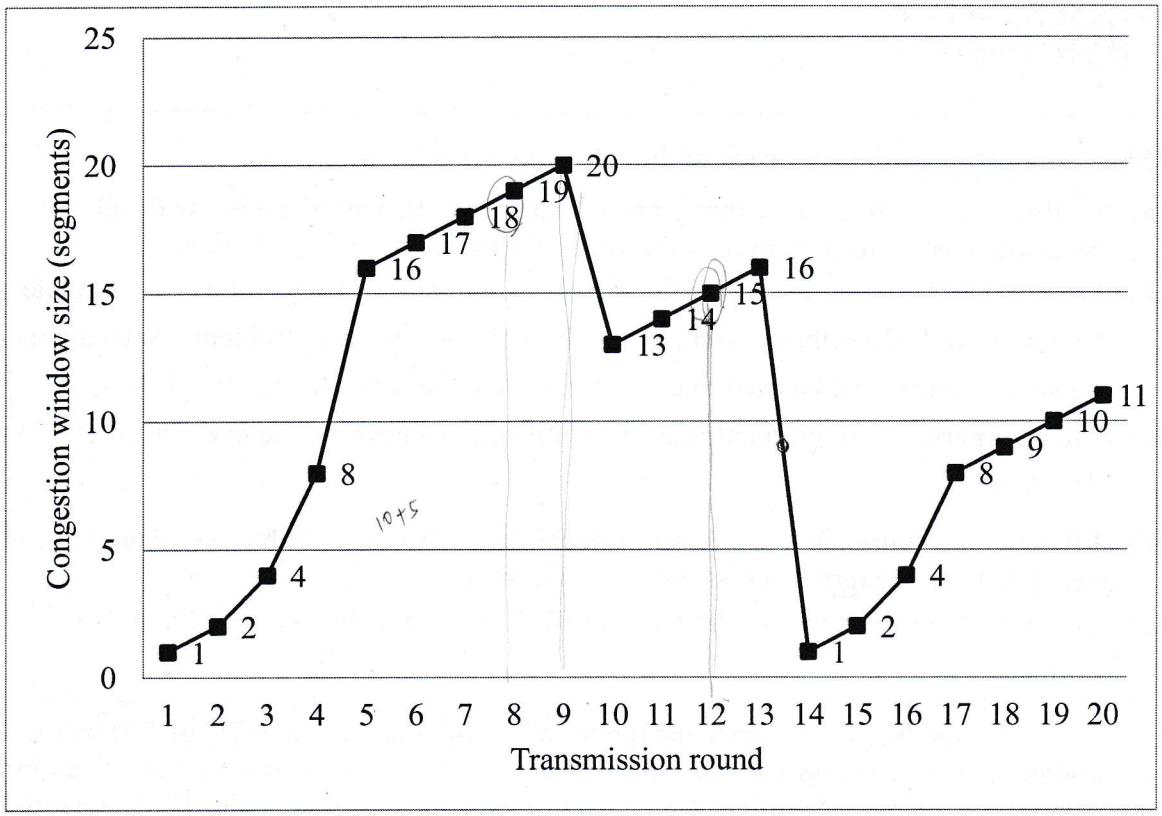
(d) (1%) What is the initial value of ssthresh at the first transmission round?

(e) (1%) What is the value of ssthresh at the 8th transmission round?

(f) (1%) What is the value of ssthresh at the 12th transmission round?

(g) (2%) During what transmission round is the 50th segment sent?

(h) (2%) Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 9th round. What are the ssthresh and the congestion window size at the 12th round?



5. (20%) Briefly explain the following terms:

(a) TCP fast retransmit

(b) Poisoned reverse technique

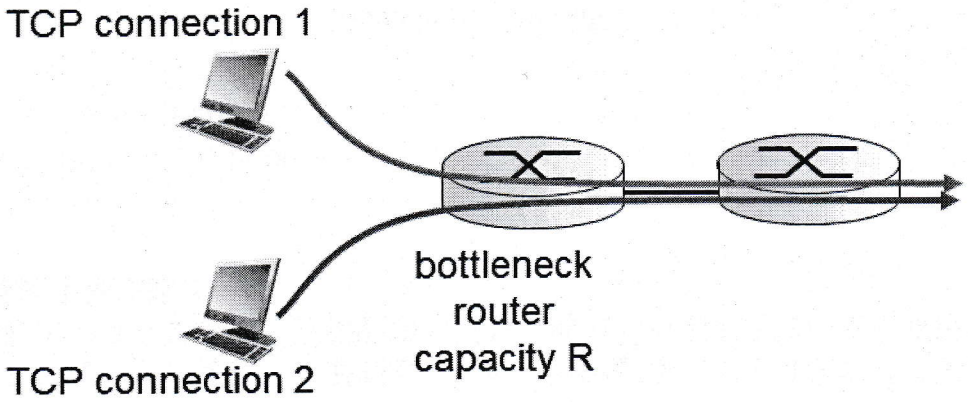
(c) Longest prefix matching rule

(d) Delayed acknowledgement

6. (15%) Suppose that there are two TCP connections sharing a single link with transmission rate *R*, as shown in the following figure.

(a) (10%) Assume that the two connections have the same MSS and RTT and have a large amount of data to send. Also, ignore the slow-start phase of TCP and assume the TCP connections are operating in CA (Congestion Avoidance) mode at all times. Explain why TCP congestion control converges to provide an equal share of a bottleneck link's bandwidth among competing TCP connections.

(b) (5%) Assume that the RTTs of these two connections are different and all other assumptions in (a) remain the same. Does TCP congestion control converge to provide an equal share of a bottleneck link's bandwidth among competing TCP connections? Explain your answer.



7. (15%) Consider three LANs interconnected by two routers, as shown in the following figure. Consider sending an IP datagram form Host E to Host B. Suppose all of the ARP tables are up to date except the ARP table of the sending host. Enumerate all the steps to show how the datagram can arrive at its destination.