

中山大学软件学院 2023 级软件工程专业 (2023 学年秋季学期)

## 《SE-301 计算机网络》期末试题 (B 卷)

(考试形式：闭卷 考试时间：2 小时)



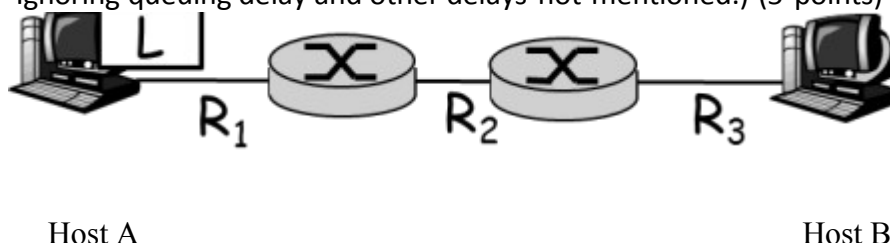
《中山大学授予学士学位工作细则》第六条

考试作弊不授予学士学位

方向： 姓名： 学号：\_\_\_\_\_

出卷： 郑贵锋、张永民、田海博 复核：

1. (10 points) How is data transferred through circuit-switched network? How long does it take to send a file of 1000 k bytes from host A to host B over a circuit-switched network? Assume that all link speeds is 500 kbps, each link uses TDM with 8 slots/sec and 0.5 sec to establish end-to-end circuit.
2. (14 points) Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of transmission rates  $R_1=250$  kbps,  $R_2=500$  kbps, and  $R_3=1$  Mbps.
  - a) Assuming no other traffic in the network, what is the throughput for the file transfer. (3 points)
  - b) Now suppose the distances of links, from left to right, are  $d_1 = 1000$  km,  $d_2 = 1000$  km, and  $d_3 = 2000$  km. And suppose the propagation speed is the same as  $2 \times 10^8$  m/s. How long does it take a packet of length 2000 bytes to propagate overall of the three links? Does this propagation delay depend on packet length? Does this delay depend on transmission rate? (6 points)
  - c) With distances and propagation speed setup above in b), and suppose  $R_2$  is reduced to 200 kbps, and the file length is 2 million bytes. Roughly, how long will it take to transfer the file from Host A to Host B? (Hints: Ignoring queuing delay and other delays not mentioned.) (5 points)



Host A

Host B



3. (12 points) Suppose within your web browser you click on a link to obtain a web page. Suppose that the IP address for the associated URL is not cached in your local host, so that a DNS look up is necessary to obtain the IP address. Suppose that  $n$  DNS servers are visited before your host receives the IP address from DNS; the successive visits incur a RTT of  $RTT_1, \dots, RTT_n$ . Further suppose that web page associated with the link contains a small amount of HTML text, and the HTML file references **SIX** very small objects on the same server. Let  $RTT_0$  denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object. Neglecting transmission times, how much time elapses with
- a) Non-persistent HTTP with no parallel TCP connections?
  - b) Non-persistent HTTP with the browser configured for 5 parallel connections?
  - c) Persistent HTTP?

**Note: Explain your answer to each question!**

4. (8 points) True or false?
- a) UDP is used for RIP routing table updates, and it is also used for DNS.
  - b) Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send to Host A. Host B will not send acknowledgments to Host A because Host B cannot piggyback the acknowledgments on data.
  - c) Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.
  - d) With GBN, it is possible for the sender to receive an ACK for a packet that fall outside of its current window.
5. (12 points) 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  $cwnd$  (congestion window, 阻塞窗口) increases by  $1MSS$  every time a batch of ACKs is received and assuming approximately constant round-trip times, how long does it take for  $cwnd$  increase from  $1MSS$  to  $6MSS$  (assuming no loss events)?
  - b) What is the average throughput (in terms of  $MSS$  and  $RTT$ ) for this connection up through  $time=5 RTT$ ?

6. (10 points) Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forward table:

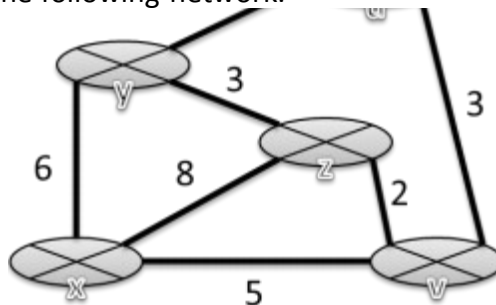
Prefix Match	Interfaces
00	0
010	1
011	2
10	2
11	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

7. (8 points) Consider the 4-bit generator,  $G = 1101$ , and suppose that the data bits to be sent is 10111011, what's the value of the CRC bits  $R$ ? Show the calculation progress.

8. (12 points) Consider sending a 3000 bytes datagram into a link that has an MTU of 500 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation?

9. (14 points) Consider the following network.



- a) With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from **node x** to all network nodes. Show how the algorithm works by computing a table similar to the following. (8 points)

0	u	2,u	5,u	$\infty$	$\infty$
1	ux	2,u	4,x	2,x	$\infty$
2	uxy	2,u	3,y		4,y
3	uxyv				4,y
4	uxyvw				4,y
5	uxyvwz				

b) How is this algorithm used in the Internet practically? (6 points)

---The End---