UESTC Student ID_____ UOG Student ID_____ Course Title_____ Lecturer_____

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Glasgow College, UESTC

Communication Networks —Semester 2, 2017 - 2018

Final Exam

10:00-12:00, 11th, July, 2018

<u>Notice:</u> Please make sure that both your UESTC and UoG Student IDs are written on the top of every sheet. This examination is closed-book and a cell phone is not permitted. All scratch paper must be adequately labeled. Unless indicated otherwise, answers must be derived or explained clearly. Please write within the space given below on the answer sheets. All questions are compulsory. There are 6 questions and a maximum of 100 marks in total.
The following table is for grader only:

Question	1	2	3	4	5	6	Total	Grader
Score								

Score

Question 1 Answer the following questions BRIEFLY (8x5=40 marks)

(1) What are the main differences between ALOHA protocol and Carrier Sense Multiple Access (CSMA) protocol? Why the channel utilization of CSMA is usually higher than that of ALOHA?

(2) Explain the main difference between Stop-and-Wait and Go-BACK-N protocol in data link layer of a computer network. Which one is better in terms of link utilization?

(3) In a computer network, both link layer and transport layer implement the reliability control (ARQ) mechanism. Explain the reasons.

(4) If User Datagram Protocol (UDP) is used for file transfer application, what kind of problem may be caused? What transport service would you use instead?

(5) Give names of the two kind of Packet-switched networks. Do they provide connection or connection-less services at network layer? Which one can ensure the packets arriving order at network layer?

(6) Given a host is identified by an IP address, why port number is necessary for running network applications? How long is a port number?

(7) When Go-back-N protocol in data link layer, some packets may be lost and the receiver discards out-of-order packets. What are the advantage and disadvantage of such an approach?

(8) In either a data link protocol or a transport layer protocol, a timeout mechanism is always needed. If there is no such timeout mechanism, can the protocol work properly? Why?

Score

Question 2 (10 marks)

A router has the following (CIDR) entries in its routing table:

Address/mask	Next hop	Interface
Default	123.45.112.0	0
123.45.48.0/20	123.45.48.1	1
123.45.56.0/22	123.45.56.1	2
123.45.60.0/22	123.45.60.1	3

Assume that a packet with destination IP address 123.45.58.16 arrives at the router. Which interface does the router forward the packet to? Explain why?

Score

Question 3 (12 marks)

Consider an error-detecting Cyclic Redundancy Check (CRC) with the generator polynomial C(x) = x5 + x4 + x2 + 1. Assume the CRC bits follow the data bits in any transmission.

(1) How long is the CRC part? How does the receiver check whether the message T is transmitted without any errors? (4 marks)

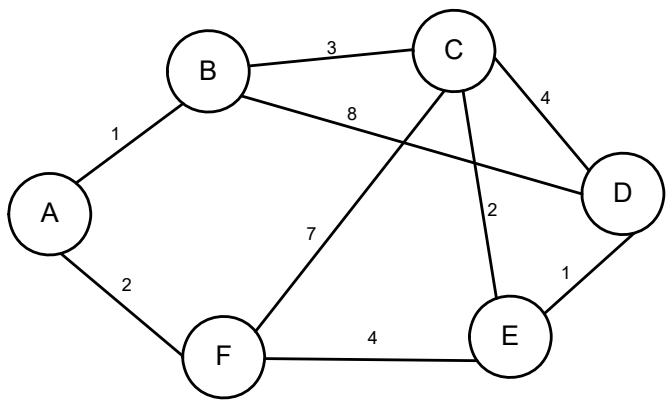
(2) Given a message M = 1010001101, determine the CRC . Show your working. (5 marks)

(3) What is the transmitted message T? （3 marks）

Score

Question 4 (12 marks)

Consider a 6-router network as shown in the Figure, the number next to a link indicates its link cost. Assume node A has collected all link state information in the network and uses Dijkstra Algorithm to compute the shortest paths from itself to all other nodes. Show the iterations by completing Table.



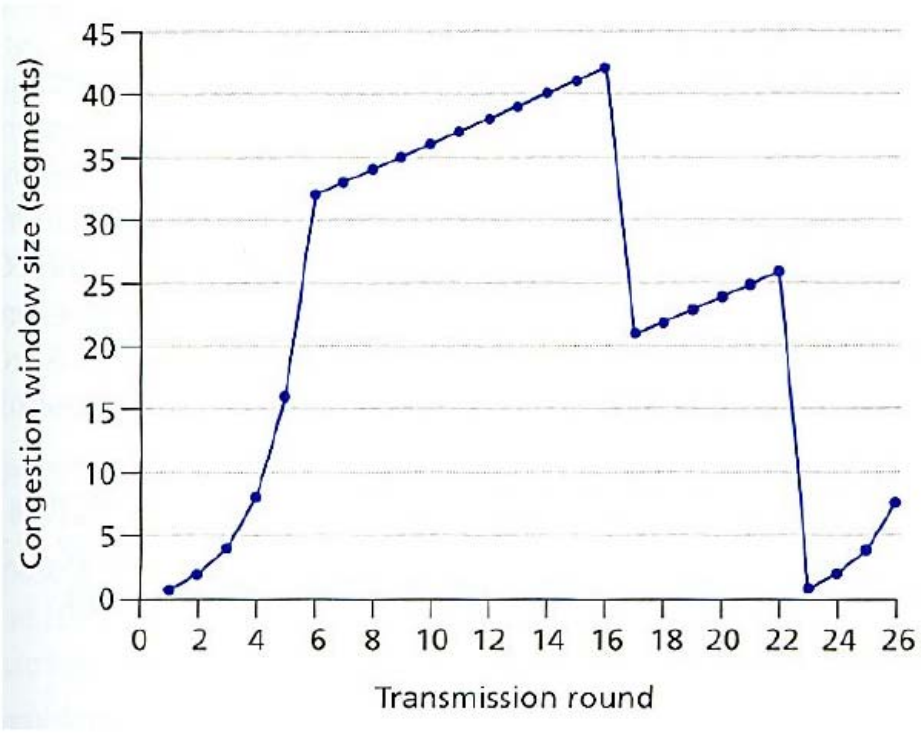
Step	Start N	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(E),p(E)	D(F),p(F)
0	A					
1						
2						
3						
4						
5						

（3 marks for each step）

Score

Question 5 (14 marks)

Consider the following plot of Transport Control Protocol (TCP) window size as a function of time. Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions.



（1）Identify the intervals of time when TCP slow start, and congestion avoidance is operating respectively. (5 marks)

（2）After the 16th and 22nd transmission round respectively, is segment loss detected by a triple duplicated ACK or by a timeout? (4 marks)

（3）What is the value of Threshold at the 18th and 24 transmission round respectively? (5 marks)

Score

Question 6 (12 marks)

Hosts A and B are connected to a router via 10-Mbps links. The propagation delay on each link is 10μs. The router is a store-and-forward device, and the time needed to process a packet at the router when the packet is received is 20 μs. Calculate the total time required to transmit 10,000 bits in the following manners.

(1) The data is transmitted a single packet. (5 marks)

(2) The data is transmitted as a 2000-bits and an 8000-bits packet sent one right after the other. Show your work. (7 marks)