

GLASGOW COLLEGE UESTC

Exam paper

Communication Networks (UESTC 2018)

Date: 1st July, 2019

Time: 09:30-11:30am

Attempt all PARTS. Total 100 marks

**Use one answer sheet for each of the questions in this exam.
Show all work on the answer sheet.**

**Make sure that your University of Glasgow and UESTC Student Identification
Numbers are on all answer sheets.**

**An electronic calculator may be used provided that it does not allow text storage
or display, or graphical display.**

**All graphs should be clearly labelled and sufficiently large so that all elements
are easy to read.**

**The numbers in square brackets in the right-hand margin indicate the marks
allotted to the part of the question against which the mark is shown. These
marks are for guidance only.**

Q1: Answer the following questions BRIEFLY.

- (1) Write down five basic functions carried out by the TCP protocol to ensure there is a reliable connection service between two communication processes. [5]
- (2) State and briefly describe the role of each of the protocol layers in the Transmission Control Protocol/Internet protocol (TCP/IP) suite. [5]
- (3) Explain why one might choose to run an application over User Datagram Protocol (UDP) rather than Transmission Control Protocol (TCP). [5]
- (4) Assume that datagrams are limited to 1,000 bytes (including the header) between the source host and destination host. Each host contributes a 20-byte IP header. Show how to calculate the number of datagrams required for sending a document of 50 KB, and the size of each datagram. [5]
- (5) Both hosts A and B are connected in a local area network such as Ethernet. How does a host A determine the MAC address of B when knowing B's IP address? [5]
- (6) Why CSMA/CD which is the MAC protocol of Ethernet cannot be applicable to wireless LAN, such as Wi-Fi? What protocol can be used for wireless LAN? [5]
- (7) State the reason why both IP address and port number are needed to support network applications, such as web browsing and email. [5]
- (8) Briefly discuss the factors affecting the queuing delay experienced by a datagram at a router in a packet-switching network. [5]

Q2: The following questions are about the Go-Back-N protocol by assuming $N=4$.

- (1) State the main advantages of Go-Back-N protocol over Stop-and-Wait protocol. [4]
- (2) Draw a sequence diagram to help the explanation and describe the drawbacks of this protocol. [8]

Q3: Suppose three active nodes A, B and C, are competing for access to a channel using slotted ALOHA. Each node attempts to transmit in each slot with probability p . The following questions assume each node has an infinite number of packets to send. The slots are numbered as 1, 2, 3, ..., and so on.

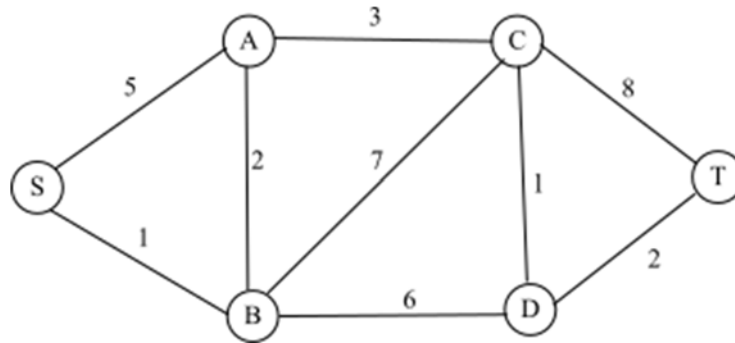
- (1) What is the probability that node B succeeds for the first time in slot 4? [4]
- (2) What is the probability that some node (either A, B or C) succeeds in slot 4? [5]

Continued overleaf

(3) What is the efficiency of this 3-node system? [3]

Q4: Router S is connected with router T through the network shown in the following figure. The number next to a link indicates the link cost. Assume node S has collected all link state information in the network. Run Dijkstra's algorithm to find the shortest path from S to all routers. Show your working by adding rows to the following table.

[12]



Step	NodeSet	D(A),p(A)	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(T),p(T)
0	S					

Q5: In computer networks, both Virtual Circuit and Datagram service modes can be used for packet transfer. Please compare these two modes with respect to a) ability to survive link or node failure, b) ability to deal with congestion in the network, and c) applicability for use with the traffic of voice or video and the traffic of file transfer. [12]

Q6: The following figure illustrates a simple network configuration, where computer A and computer B are connected through two routers. The data processing speed in each router is 10 Mbps. Computer A will transmit a packet with size of 20kB to computer B through the two routers. The queuing delay in the two routers are 1 ms and 2 ms, respectively. The maximum data rates for the three links involved are 100Mbps, 1 Gbps and 10Mbps, respectively. Show how to calculate the transmission delay and overall delay from A to B. [12]



End of question paper