UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2008/2009 – 2nd Year Examination – Semester 4

IT4503 : Data Communication and Networks

Part 2: Structured Question Paper

16th August, 2009

(ONE HOUR)

To be completed by the candidate

BIT Examination Index No: _____

Important Instructions:

- The duration of the paper is **1 (one) hour**.
- The medium of instruction and questions is English.
- This paper has **3 questions** and **7 pages**.
- **Answer all questions.**
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.

Questions Answered

Indicate by a cross (×), (e.g. [X]) the numbers of the questions answered.

	Question numbers			
To be completed by the candidate by marking a cross (×).	1	2	3	
To be completed by the examiners:				

Index No …….

1) a. (i) The probability that k frames are generated during a given frame time in a pure Aloha network is given by the Poisson distribution:

$$Pr[k] = G^k e^{-G} / k!$$

G is the mean offered load per frame time.
What is the maximum expected throughput of a pure Aloha network?

[8 Marks]

ANSWER IN THIS BOX

1/2e

(ii) What should be the mean offered load per frame time to achieve the maximum throughput in PureAloha?

[4 Marks]

ANSWER IN THIS BOX

0.5 Frames per frame time

b.

(i) The one-way propagation delay between the two stations furthest apart in a CSMA/CD network is T seconds. How long will it take for a station to ensure that it can complete the transmission of a frame without interference from other stations?

[6 Marks]

ANSWER IN THIS BOX

2T seconds

(ii) Briefly describe the Binary Exponential Back off algorithm in Ethernet.

[12 Marks]

ANSWER IN THIS BOX

After a collision, each station waits a 0 or 1 time slots (selected randomly) before attempting to send again. After the second collision, they wait 0, 1, 2 or 3 time slots selected randomly. After the third collision, the number of time slots to wait is selected randomly out of 0, 1, 2, 3, 4, 5, 6 and 7. This continues until the station transmits successfully or the randomization interval reaches 1023.

2 (a) In a particular TCP connection the current size of the congestion window is 2048 bytes and the threshold is 64,000 bytes. The sender has received acknowledgements for all the bytes transmitted. What should be the new value of the congestion window?

[6 marks]

ANSWER IN THIS BOX

4096 Bytes

(b) Explain why TCP is not considered as a good protocol for a wireless network.
Hint: Consider the TCP congestion control algorithm and its effect in a wireless network.

[12 Marks]

ANSWER IN THIS BOX

TCP assumes that packet loses are due to congestion and when it detects a packet loss, it slows down the sending rate. However, in a wireless network, the error rate is high and more packets are lost due to errors and not due to congestion. In such a scenario, the sender should not slow down.

(c) Describe Nagle's algorithm used in TCP.

[12 marks]

ANSWER IN THIS BOX

When data comes to the sender one byte at a time, send the first byte and buffer the rest until the first byte is acknowledged. Then send the buffered bytes in one TCP segment. This reduces number of TCP segments sent with one byte payloads.

3 (a) A host in a network is configured with the IP address 10.16.48.10 and the subnet mask 255.255.240.0. What is the broadcast address of this network and the valid address range?

[8 marks]

ANSWER IN THIS BOX

10.16.63.255

10.16.48.1 -10.16.63.254

(b) Describe the "Hidden Station problem" in wireless LAN.

[12 marks]

ANSWER IN THIS BOX

Assume that the stations A and C are in the range of the station B but A and C are not within the range of each other. If A is transmitting to B, C cannot hear the transmission. In this situation C may transmit under the false assumption that B is not receiving signals from other stations. The signals from A and C collide at B.

(c) Give the Hamming code for the data word 1100101.

[10 Marks]

ANSWER IN THIS BOX

00111000101

(d) In a certain wide area network topology, the router A is connected to B, and B is connected to the router C. The routers use a distance vector routing protocol and they have already exchanged the routing information. Assuming that the link between A and B goes down, describe the "count to infinity" problem.

[10 marks]

ANSWER IN THIS BOX

Now B detects that the BA link is down and it does not have a route to A anymore. However, in the next routing information exchange, C can inform B that it has a route to A. However, this is the same route that C learned from B but there is no means for B to realize that. This new route that B learns from C is longer than the route that B knew earlier. This process of passing back and forth the false route can go on forever. This is the count to infinity problem.

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