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UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

UCSC

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Academic Year 2018/2019 – Second Year Examination – Semester I – 2019

SCS 2205 – Computer Networks I

TWO (2) HOURS

To be completed by the candidate

Examination Index No: .....

Important Instructions to candidates:

1. The medium of instruction and questions is **English**.
2. If a page or a part of this question paper is not printed, please inform the supervisor immediately.
3. Note that questions appear on both sides of the paper. If a page is not printed, please inform the supervisor immediately.
4. Write your index number on each and every page of the question paper.
5. This paper has **4** questions and **14** pages.
6. Answer **ALL** questions. All questions carry equal marks (**25** marks).
7. Any electronic device capable of storing and retrieving text including electronic dictionaries and mobile phones are **not allowed**.
8. Non-programmable calculators are **allowed**.

For Examiner's use only	
Question No	**Marks**
1	
2	
3	
4	
Total	

1.

(a).

(i). A reasonable assumption for traffic coming out of a data source would be Poisson (i.e., inter arrival times of data packets which are exponentially distributed). Compared to data, what would be the most likely arrival pattern for a digitized voice or video stream? Explain.

[03 marks]

(ii). In an extra-terrestrial space communications link, typically, only simplex links are allowed. Under such conditions, what type of error recovery, forward error correction (FEC) or (automatic repeat request) ARQ is possible? Explain.

[03 marks]

ANSWER IN THIS BOX

(b). A data signal which has a baud rate (= samples per second) of 80kbps is to be transmitted over a communication channel of 1MHz and a signal to noise ratio of 30dB. What is the maximum number of quantization levels possible, if the data signal is to be transmitted at the maximum allowed rate? State any theorems used.

[08 marks]

ANSWER IN THIS BOX

(c). A communication channel is shared between several data sources.

(i). State two commonly used dynamic channel access resolution methods.

[02 marks]

(ii). Under heavy traffic, which of the two in (i) would perform worse? Why?

[02 marks]

(iii). Derive an expression for the 'collision vulnerable period' for a CSMA/CD bus, given the following parameters.
c (meters per second) - the EM propagation velocity
R (Mbps) - the data rate on the bus
d (meters) - the end to end length of the bus

[07 marks]

ANSWER IN THIS BOX

Continued ...

Examination Index No: _____

ANSWER IN THIS BOX

2.

(a). What is the main difference between the Shielded Twisted Pair (STP) and the Unshielded Twisted Pair (UTP) cables?

[04 Marks]

ANSWER IN THIS BOX

(b).

(i). Why do fiber optic cables work better than copper as the physical transmission media for network backbones?

(ii). Briefly explain two (2) disadvantages of fibre optic cables compared to copper cables.

[6 Marks]

ANSWER IN THIS BOX

(c).

(i). Briefly explain the reliability and performance of Store and Forward switching as opposed to Cut Through switching.

(ii). With the use of Virtual LANs (VLANs), inter switch links can be configured as trunks to carry frames from several Ethernet networks to others. How does an IEEE 802.1Q switch identify frames from different VLANs?

[06 Marks]

ANSWER IN THIS BOX

(d).

(i). What are the two (2) types of networks that can exist at the data link layer?
(ii). What is the role of the Preamble field of the Ethernet frame?
(iii). What is the minimum payload size of the Ethernet frame? Justify your answer.

[09 Marks]

ANSWER IN THIS BOX

3.

(a). An IP datagram carrying 2740 bytes of payload must be sent over a link that has an MTU of 905 bytes. Assume the datagram has no Options, and the Identification number is 0x12B6. Also, assume that the DF bit is not set in this datagram. After fragmentation, show each fragment's corresponding values in the table below. Corresponding fragments are numbered as 1, 2, 3, … in the table to denote each fragment.

[08 Marks]

ANSWER IN THIS BOX

	Identification No.	Total Length	Fragment Offset	MF Flag
1				
2				
3				
4				

(b).

(i). What is the aggregated IP block that corresponds to the IP address blocks from 100.208.0.0/16 to 100.223.0.0/16 consecutively?

(ii). Briefly explain how the concept of Network Address Translation (NAT) can be used to load-balance servers.

[07 Marks]

ANSWER IN THIS BOX

(c). You have been asked to design and apply an IP addressing scheme for a network given below. The total IP address space given to you is **212.42.144.0/20**.

LAN 1 Capacity	**1500 Hosts**
LAN 2 Capacity	**800 Hosts**
LAN 3 Capacity	**250 Hosts**

(i). Write down the **network address, broadcast address** and the correct **subnet mask** in **CIDR** notation for LAN 1, LAN 2 and LAN3 in the table given below. Show your workings clearly in the space given in the answer box.

(ii). Write down the number of **unallocated IP address block(s)** available after the above allocation, indicating their network addresses and the corresponding subnet masks in CIDR notation.

[10 Marks]

ANSWER IN THIS BOX

Segment	Network Address	Broadcast Address	Subnet mask in CIDR
LAN 1			
LAN 2			
LAN 3			
Leased Line			

Continued ...

Examination Index No: _____

4.

(a). Answer the following questions with regard to the IPv4 Header.

(i). The ***header length*** field of an IPv4 datagram contains the value **1110**. Write down the size (in bytes) of the ***Options*** field of the above datagram.

(ii). How does an IPv4 router block all incoming UDP traffic?

(iii). Write down three (3) header fields in an IP datagram that will always change as it leaves a router, with IP Masquerading enabled, on its way towards the destination.

[09 marks]

ANSWER IN THIS BOX

(b). Answer the following questions regarding the IPv6 header.

(i). Briefly explain how extension headers can be added to IPv6 datagrams.

(ii). Write down the IPv6 address 2002:000A:0000:0000:2002:0A00:0000:0000 in abbreviated form.

(iii). Write down the 64-bit IEEE Extended Unique Identifier (EUI) for the MAC Address 51-35-11-11-35-53.

(iv). Briefly explain how one can configure a network to support both IPv4 and IPv6 traffic.

[12 marks]

ANSWER IN THIS BOX

(c). Write down the correct application layer protocols and the corresponding transport layer protocols for the Internet applications listed in the table below.

[04 marks]

ANSWER IN THIS BOX

Application	Application Layer Protocol	Transport Layer Protocol
Email		
Web		
Bulk File Transfer		
Voice over IP (VOIP)		

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