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UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Academic Year 2017/2018 – Second Year Examination – Semester I – 2018

SCS 2105 – 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 **13** 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). Briefly describe the following:

(i). A distribution which is commonly used to model the data packet arrival process on a network.

(ii). RTZ vs. NRZ Signal encoding (use an example binary data stream to explain).

(iii). Simplex vs. Duplex transmission modes.

[06 marks]

ANSWER IN THIS BOX

(b). Consider a conventional analogue signal which is to be digitized and transmitted over a communications link.

(i). If the analogue signal is band limited to 5 MHz and quantized at 12 bits/sample, what is the minimum data rate of the equivalent digitized signal? State any theorems used.

(ii). Sixteen (16) such digitized signals are multiplexed on to make one combined channel. What is the data rate of the combined channel?

(iii). Suppose now the signal of (a) is to be sent over a channel of 5 MHz bandwidth and a signal to noise ratio of 20dB. Can it be done? Explain using relevant theorems.

[09 marks]

ANSWER IN THIS BOX

(c). Suppose a broadcast channel (i.e., Aloha like) is to be shared by many users for packet data communication. Full bandwidth is available to a successful user who acquires the channel at any given time.

(i). Aloha protocol is a probabilistic channel access method. In Aloha, as the offered load increases the throughput. Why? In what way would a token-based access method (i.e., Token ring/ Token bus) behave differently?

(ii). Carrier sense multiple access/collision detect (CSMA/CD) is the core protocol of Ethernet. Derive the 'vulnerable period' and the 'minimum packet length' for CSMA/CD, given the parameters **c** (m/s) - the EM propagation velocity; **R** (Mbits/sec) - the data rate, and **d** (meters) - the end to end length of the broadcast bus.

[10 marks]

ANSWER IN THIS BOX

2.

(a). What is the main reason the cables are twisted in a twisted pair cable?

[04 Marks]

ANSWER IN THIS BOX

(b).

(i). Write down four (4) advantages Fiber Optic cables have compared to Copper cables?

(ii). Briefly explain two (2) ways a Fiber Optic cable can be combined when it is broken.

[6 Marks]

ANSWER IN THIS BOX

(c).

(i). What is the main difference between an Ethernet switch and a router?

(ii). Ethernet switch's forwarding table is a dynamic table that maps MAC addresses to switch ports. How does it learn the above mapping initially?

(iii). What is meant by Virtual LANs (VLANs)?

[06 Marks]

ANSWER IN THIS BOX

(d).

(i). Using a diagram, show the difference between the IEEE 802.3 frame header and the Ethernet frame header.

(ii). Briefly explain how the two headers in question (d)(i) co-exist at a Layer 2 switch.

(iii). Write down three (3) reasons why Ethernet is the most popular form of wired LAN technology today.

[09 Marks]

ANSWER IN THIS BOX

3.

(a). An IP datagram carrying 10000 bytes of data must be sent over a link that has an MTU of 4468 bytes. Assume the datagram has no Options, and the Identification number is 218. Also, assume that the DF bit is not set in this datagram. After fragmentation, show each fragment's corresponding values in the table below. You can label corresponding fragment numbers as 1, 2, 3, … in the table to denote each fragment.

[09 Marks]

ANSWER IN THIS BOX

Fragment No.	Total Length	Fragment Offset	MF Flag

(b).

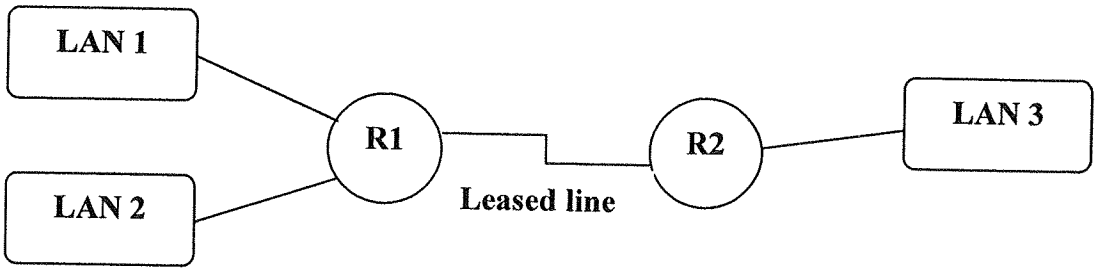
(i). What is the aggregated IP block that corresponds to the IP address blocks from 10.50.24.0/24 to 10.50.31.0/24 consecutively?

(ii). What is meant by IP Masquerading?

[06 Marks]

ANSWER IN THIS BOX

(c). You have been asked to design and apply an IP addressing scheme for the topology given in the figure below and the corresponding table. The IP address space given to you is **10.55.210.0/23**.



LAN 1 Capacity	**130 Hosts**
LAN 2 Capacity	**100 Hosts**
LAN 3 Capacity	**50 Hosts**

(i). Write down the **network address, broadcast address** and the correct **subnet mask** in **CIDR** for LAN 1, LAN 2, LAN3 and Leased Line 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)** with its network address and the corresponding subnet mask after the above address scheme allocation.

[10 Marks]

ANSWER IN THIS BOX

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

Continued ...

4.

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

(i). The ***header length*** field of an IPv4 datagram contains the value **1000**. Write down the size (in bytes) of the ***Options*** field of the above datagram.

(ii). Is there a possibility for an IP router to know the transport layer protocol of an incoming datagram? Justify your answer.

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

[09 marks]

ANSWER IN THIS BOX

(b). Answer the following questions with regard to the IPv6 header.

(i). Briefly explain how loops are prevented from forwarding IPv6 datagrams.

(ii). Write down the IPv6 address 2000:200A:0000:0000:0000:200A:0000:0200 in abbreviated form.

(iii). Write down the 64-bit IEEE Extended Unique Identifier (EUI) for the MAC Address 10-21-BE-AD-21-12.

(iv). IPv6 header has moved out fragmentation fields from the base header. How does IPv6 header support fragmentation?

[12 marks]

ANSWER IN THIS BOX

(c).

(i). Why does TCP use a three-way handshake?

(ii). Using a sketch, show how a three-way handshake can be established.

[04 marks]

ANSWER IN THIS BOX

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