University of Colombo, Sri Lanka

UCSC *University of Colombo School of Computing*

BACHELOR OF SCIENCE IN INFORMATION SYSTEMS

Second Year Examination — Semester II— UCSC AY19 [held in March/April/May 2023]

IS 2111 — Computer Networks

(2 Hours)

Answer All Questions

Number of Pages = 8 Number of Questions = 4

To be completed by the candidate								
Index Number								

Important Instructions to candidates:

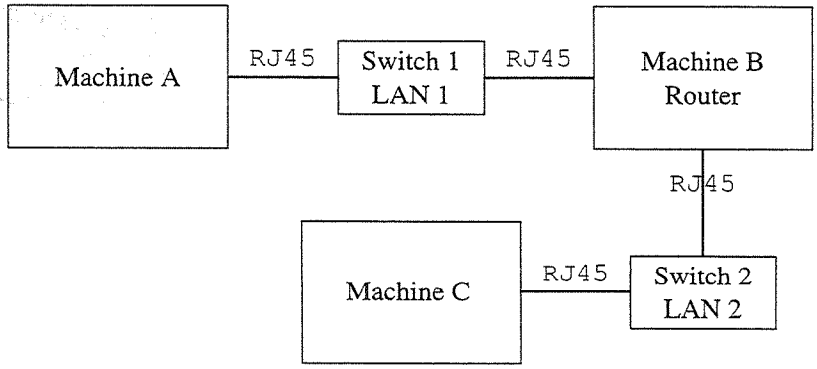
- Students should answer in the medium of English language only using the space provided in this question paper.
- Note that questions appear on both sides of the paper. If a page or a part of this question paper is not printed, please inform the supervisor immediately.
- Write your index number CLEARLY on each and every page of this Question paper.
- This paper consists of **4** questions in **8** pages (including the Cover Page).
- Answer ALL questions.
- Calculators and any electronic device capable of storing and retrieving text including electronic dictionaries, smart watches and mobile phones are not allowed.
- 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

To be completed by the examiners

1	
2	
3	
4	
Total	

Index Number | | | | | | | | |

1. A network is depicted in the following diagram. Only the machines shown in the diagram are in the network.



The operating system on **B** is Linux and the `ifconfig` command executed on a terminal on **B** is given bellow.

```
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 10.0.2.5  netmask 255.255.255.252  broadcast 10.0.2.7
    inet6 fe80::4757:ec9:e144:8330 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:4f:e5:10  txqueuelen 1000  (Ethernet)
    RX packets 15390  bytes 21938777 (21.9 MB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 4780  bytes 312500 (312.5 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 10.0.3.9  netmask 255.255.255.252  broadcast 10.0.3.11
    inet6 fe80::cd3:1a32:4e7:f4c7 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:f9:cf:12  txqueuelen 1000  (Ethernet)
    RX packets 4  bytes 1596 (1.5 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 61  bytes 7128 (7.1 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    inet6 ::1  prefixlen 128  scopeid 0x10<host>
    loop  txqueuelen 1000  (Local Loopback)
    RX packets 86  bytes 7618 (7.6 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 86  bytes 7618 (7.6 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

An IPv4 packet **P** sent by a program on machine **A** is received by the machine **C**. The source MAC address of the Ethernet frame containing **P** when it was received at **C** was **08:00:27:f9:cf:12**.

Index Number | | | | | | | | |

(a). What is the source IP address of **P** ? Write your answer as a **binary** string.

[5 marks]

(b). What is the network address of LAN1?

[3 marks]

(c). What is the destination IP address of **P** when it was received at **B**?

[5 marks]

(d). What is destination MAC address of the Ethernet frame containing **P** when it was in LAN1?

[3 marks]

(e). What is the network address of LAN2?

[5 marks]

(f). Write the subnet mask of LAN1 as a binary string?

[4 marks]

Index Number | | | | | | | | |

2. (a). An organisation owns the IP address blocks 192.168.16.0/24 and 192.168.17.0/24. It has created a network consisting of 400 hosts using these two blocks.

i. What is the subnet mask of this network in CIDR notation?

[3 marks]

ii. What is the network address of this network?

[3 marks]

iii. What is the broadcast address of this network of the network?

[3 marks]

(b). An experiment was conducted on a channel connecting the machine **X** to **Y**. Randomly generated 10^6 bits were sent on this channel from **X** to **Y** during this experiment and it was observed that only 999000 bits were received at **Y** without any errors. All the other bits were flipped by the time they reached **X**. Equal number of 1 and 0 bits were in the correctly received bits and the same ratio was observed in the flipped set of bits as well.

Later, it was decided to use this channel to send messages from **X** to **Y** using the following encoding. The message bit 1 is sent encoded as 11 and the message bit 0 is sent encoded as 00 on this channel.

i. The message bit 1 is encoded and sent on this channel. What is the probability that the receiver receives the message correctly?

[3 marks]

ii. The data bit 0 is encoded and sent on this channel what is the probability that the receiver incorrectly decode the received string and receive the wrong data?

[4 marks]

iii. A one bit message is encoded and sent on this channel. What is the probability that the receiver discards the received string?

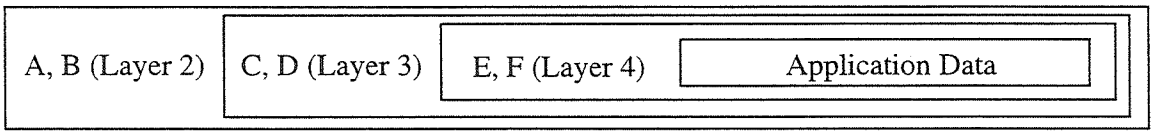
[4 marks]

Index Number | | | | | | | | |

(c). A machine **M** has two network interfaces. One interface is connected to a network that uses private IP address. The other interface is connected to the public Internet. Users of the private network require Internet access for web browsing. Several web sites that serves static content are quite popular among the users of the machines on the private network. What is the most suitable technology to be used on the machine **M** to provide Internet access to the machines on the private network? Justify your answer.

[5 marks]

3. (a). The following diagram shows the encapsulation of application data in the OSI network protocol stack. Assume that the application is using UDP as the Layer 4 protocol.



i. State the name of the layers used in the OSI protocol stack for Layer 2, Layer 3, and Layer 4 and their corresponding protocol data unit (PDU).

[4 marks]

Index Number | | | | | | | | |

ii. A, B, C, D, E, and F are the most important information used in each layer to identify the parties which are communicating. List down each of them in the **correct order** as their in the relevant PDU headers.

[6 marks]

iii. ***A*** precedes ***B*** in the Layer 2 PDU header. Explain the reason for arranging ***A*** and ***B*** in this order.

[5 marks]

(b). Discuss the main difference between HTTP/1.0 and HTTP/1.1.

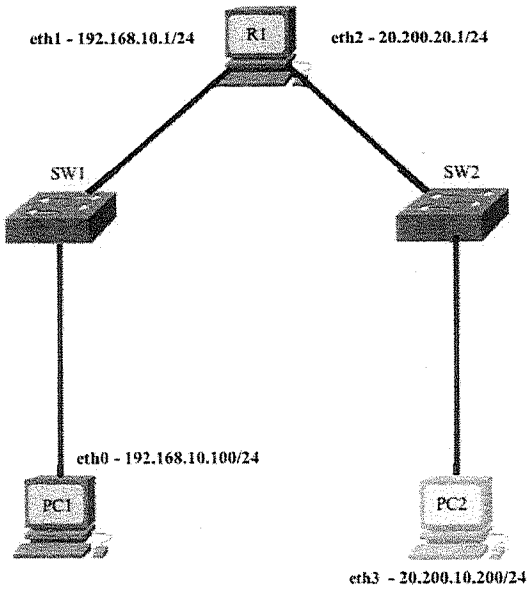
[5 marks]

(c). There is a web page with 5 jpeg images. Consider the round trip time (RTT) as ***T*** and the time taken to transmit any object from the server to the client is ***t***. Calculate the total time taken for the communication if the client uses HTTP/1.1 protocol.

[5 marks]

Index Number | | | | | | | | |

4. (a). Consider the following network setup.



A network administrator tries to execute the following command to assign IP addresses on PC1.

```
sudo ifconfig eth0 192.168.10.100 netmask 255.255.255.0
```

But an error prompted as the `ifconfig` command is not available.

i. What could be the reason for this error message?

[2 marks]

ii. Write an alternative Linux command to assign IP address to the network interface of PC1.

[8 marks]

Index Number | | | | | | | | |

iii. The network administrator has configured IP addresses on all the interface (eth0, eth1, eth2, eth3). But still the users cannot communicate between PC1 and PC2. Determine the reasons for the problem.

[5 marks]

(b). Mention a problem of Unshielded Twisted Pair (UTP) cables.

[2 marks]

(c). Write a Wireshark filter to filter network traffic coming from ip address 192.168.10.23.

[2 marks]

(d). Write a Wireshark filter to filter TCP traffic associated with ip address 192.168.10.23.

[4 marks]

(e). What is the mode of fibre media which use LED to transmit signals.

[2 marks]

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