



University of Ruhuna - Faculty of Technology
Bachelor of Information and Communication Technology
Level 1 (Semester II) Examination, November/December 2025
Academic year 2023/2024

Course Unit: ICT1253 Computer Networks (Written)

Duration: 2 hours

Answer all questions

1.

a)

- i. Briefly explain the term **computer networks**. [05 marks]
- ii. Describe two (02) major applications of computer networks in a business setting. [10 marks]

b)

- i. Briefly describe the Client-Server network architecture using a real-world example. [05 marks]
- ii. List two (02) advantages and two (02) disadvantages of the Client-Server model compared to the Peer-to-Peer model. [20 marks]
- iii. Identify two (02) social issues that arise due to the widespread use of computer networks. [10 marks]

c)

- i. List one (01) advantage and one (01) disadvantage of each of the following Local Area Network (LAN) topologies:
 - Bus
 - Ring
 - Star
 [30 marks]
- ii. Explain how a **Metropolitan Area Network (MAN)** differs from a **Wide Area Network (WAN)** in terms of structure and application. [05 marks]

- d) Using Shannon's Theorem, calculate the maximum achievable data rate (channel capacity) for a noisy communication channel with:
- Bandwidth = 20 kHz
 - Signal-to-noise ratio (SNR) = 2047
- [15 marks]

2.

a) Convert the following binary IP addresses to dotted-decimal notation.

- i. 11000000 10101000 00001010 00011110
- ii. 10101100 00010010 00011100 00000111

[10 marks]

b) The following are classful IP addresses. Identify the **class** of each IP address:

- i. 167.31.45.5
- ii. 124.50.255.13

[10 marks]

c) "A subnet, or subnetwork, is a network inside a network."

- i. Briefly explain the purpose of subnetting in IP addressing. [08 marks]
- ii. State two (02) advantages of subnetting? [10 marks]

d) A class A network **11.0.0.0/8** is subnetted using the subnet mask **255.240.0.0**. Calculate:

- i. The maximum number of subnets that can be created. [05 marks]
- ii. The number of usable hosts can be created per subnet. [05 marks]
- iii. For the first two subnets, identify the following:
 - I. Network address
 - II. Broadcast address

[20 marks]

e) GreenEarth Solutions Inc. has been allocated the network **10.25.8.0/24** for internal use.

The company has the following divisional networking requirements:

Division	No. of usable hosts required
Research	60
Sales	30
Field Operations	80
Human Resources	20

Using the **unequal subnetting** concept, find the following for each division

- i. Subnet mask
- ii. Usable IP range

[32 marks]

3.

- a) "Unguided signals can travel from the source to the destination in several ways." Briefly explain the difference between **ground propagation** and **sky propagation**. [20 marks]
- b) "The Transport Layer in the OSI model is responsible for providing end-to-end communication between applications running on different hosts."
i. Briefly explain **multiplexing** and **demultiplexing** in the Transport Layer. [20 marks]
ii. Describe how **port numbers** help the Transport Layer to perform multiplexing and demultiplexing. [10 marks]
iii. Define the term **Maximum Transmission Unit (MTU)** and explain its importance in data transmission. [10 marks]
- c) R.W. Hamming introduced the method called "**Hamming code**", which is used for error control during network transmission. Consider the 7-bit Hamming code to answer the following questions.
i. Illustrate the structure of a 7-bit Hamming codeword. [10 marks]
ii. For data bits **1011**, assuming even parity, calculate the parity bits and generate the 7-bit Hamming codeword. [15 marks]
iii. Suppose you received a 7-bit Hamming code: **1110101** with even parity. Determine if an error exists and identify the error position if applicable. [15 marks]

4.

- a) In data communication, window policy is used as an open-loop congestion control mechanism.
i. Briefly explain **window size** in open-loop congestion control. [10 marks]
ii. Briefly explain why the **Selective Repeat** window policy is more efficient than **Go-Back-N** in reducing network congestion. [10 marks]
- b) Explain how the **Leaky Bucket Algorithm** is used for traffic shaping and congestion control. [20 marks]
- c) For each of the following situations, indicate the most appropriate network protocol to use.
i. Securely accessing a website and transferring sensitive information, such as login credentials.
ii. Uploading/downloading files to/from a remote server.
iii. Sending an email from a client to a mail server.

- iv. Retrieving emails from a server and storing them locally and removing them from the server after downloading.
 - v. Accessing emails directly on the mail server without downloading them.
- [10 marks]

d) Consider the directional graph shown in Figure 1, where the distances between each pair of routers are indicated on the links.

Using **Dijkstra's Shortest Path Algorithm**, compute the **shortest path** and **shortest distance** from **Router A** to **Router G**.

Present all steps of your calculation clearly in a **table format**.

[50 marks]

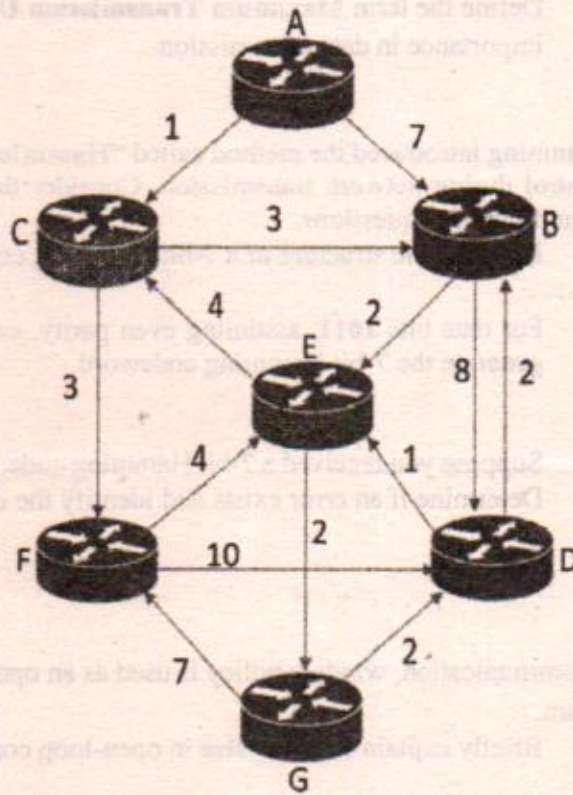


Figure 1

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