



## UNIVERSITY OF RUHUNA

### Faculty of Engineering

End-Semester 5 Examination in Engineering: March 2022

Module Number: EE5302

Module Name: Computer Networks – (N/C)

[Three Hours]

[Answer **all** questions, each question carries 10 marks]

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- Q1 a) Describe two advantages of layering in computer networks. [1.0 Marks]
- b) With the help of diagrams, briefly describe the following methods used for data encoding. [3.0 Marks]
- i) Unipolar encoding
  - ii) Polar encoding
  - iii) Bipolar encoding
- c) The loss in a transmission cable is usually expressed in decibels per kilometer (dB/km). If the power of a signal at the beginning of a cable with  $-0.3$  dB/km loss is  $3\text{mW}$ , what is the power of the signal at  $4$  km? [2.0 Marks]
- d) Data transmission in computer networks can be synchronous or asynchronous transmissions. [2.0 Marks]
- i) In asynchronous transmissions, what is the purpose of having a start bit, parity bits and a stop bit?
  - ii) How can you reduce the overhead introduced by these bits?
- e) State two advantages **each** for using Packet switching and Circuit switching in computer networks. [2.0 Marks]
- Q2 a) Briefly explain the requirement of having random access protocols in computer networks. [1.5 Marks]
- b) Describe the stepwise working principle of Carrier Sense Multiple Access/Collision Detection (CSMA/CD) access control used in Ethernet. [2.0 Marks]

- c) Briefly describe the self-learning process happening in a switch. What are the entries in a switching table that would be updated during this process?

[2.0 Marks]

- b) Consider the three LANs (Local Area Networks) interconnected by a router, as shown in Figure Q2. The IP and MAC addresses are shown for nodes A, B, C and D, as well as for the router's interfaces. Consider an IP datagram being sent from node A to node C and answer the following questions. Assume that node C's MAC address is not available at Node A.

- What are the source and destination MAC addresses at point (1)?
- What are the source and destination IP addresses at point (1)?
- What are the source and destination MAC addresses at point (4)?

[3.0 Marks]

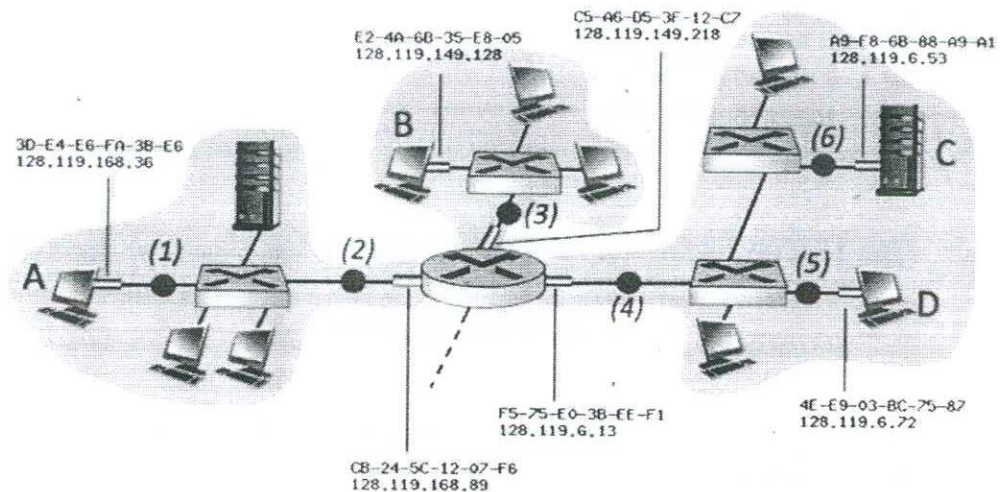


Figure Q2

- d) Briefly describe three advantages of creating Virtual Local Area Networks (VLANs).

[1.5 Marks]

- Q3 a) Answer the following questions using your knowledge on IPv4 and IPv6 protocols and their coexistence.

- Describe two limitations of IPv4 and how these limitations are overcome by IPv6.

[1.5 Marks]

- Briefly explain three methods used to have the coexistence of IPv4 and IPv6 networks.

[1.5 Marks]

- b) You are given two computer networks with different sizes. One large network with more than 1000 nodes and a smaller network with less than 100 nodes. State which routing protocol among the link state routing and distance vector protocol that you would select to deploy in each network. Explain the reasons for your selection considering the characteristics of routing protocols.

[3.0 Marks]

- c) You are given a network address of 192.168.2.0/24. Use variable length subnet masking to design a solution to accommodate host requirements of all the segments in the network given in Figure Q3. Calculate the network address and subnet mask for each segment. Provide explanations for your choices. (Assume that the relevant router interface is included in the number of hosts mentioned in the figure).

[4.0 Marks]

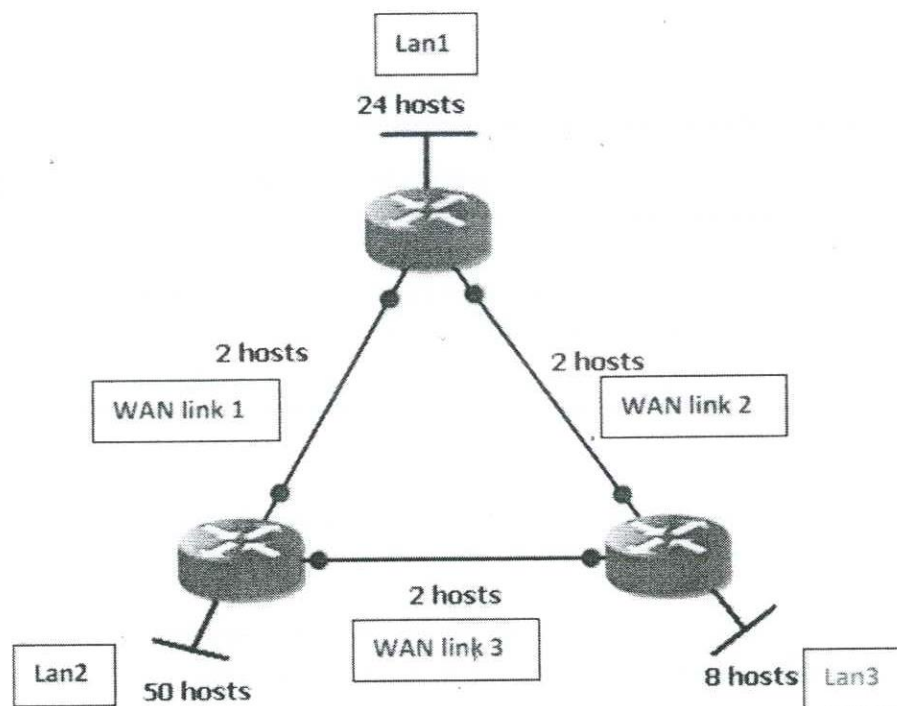


Figure Q3

- Q4 a) Briefly explain connection-oriented and connectionless demultiplexing occurring at the transport layer. Mention the parameters that are considered in the demultiplexing process for each case.

[2.0 Marks]

- b) The UDP segment header contains a checksum field that is used for detecting errors.

- ii) Explain the UDP checksum process mentioning the roles of the sender and the receiver of a UDP segment.

[1.5 Marks]

- ii) If no errors are detected at the receiver, can we guarantee that there are no flipped bits in the received signal compared to the transmitted signal? Give reasons for your answer. [1.0 Mark]
- c) Answer the following questions using your knowledge on TCP.
- i) What information can you obtain from the sequence number and acknowledgement fields in the TCP header? [1.5 Marks]
- ii) Discuss the importance of setting a proper TCP timeout value. What happens if the TCP timeout value is set too short or too long? [1.5 Marks]
- iii) With the help illustrations, explain the TCP fast retransmission concept. [1.0 Mark]
- iv) Briefly explain the main difference between the flow control and congestion control mechanisms employed in TCP. [1.5 Marks]
- Q5 a) The Hypertext Transfer Protocol (HTTP) connections can be categorized into persistent and non-persistent connections.
- i) What is the main difference between persistent and non-persistent HTTP connections? [1.0 Mark]
- ii) What is the response time per object for non-persistent HTTP connections? Explain how you obtain your answer. [1.0 Mark]
- iii) How does the above-mentioned response time is reduced in persistent HTTP connections? [1.0 Mark]
- b) Explain Head of Line (HOL) blocking experienced in HTTP version 1.1. How does HTTP version 2 mitigate the HOL blocking problem? [2.0 Marks]
- c) The domain name system (DNS) can be viewed as a distributed database implemented in a hierarchy of many name servers.
- i) What is the main purpose of a DNS? [1.0 Mark]
- ii) State four issues of having a centralized DNS. [1.0 Mark]
- iii) Briefly explain the three hierarchical level DNS servers that would be queried by the client when a domain name is searched. [1.5 Marks]
- d) What is a web cache? State two advantages of web caching. [1.5 Marks]