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University of Ruhuna - Faculty of Technology

Bachelor of Information & Communication Technology Honours Degree
Level 2 (Semester II) Examination, November/December 2022
Academic Year 2020/2021

Course Unit: ICT2223 – Computer Networks (Written)

Answer **all four (04)** questions **Time Allowed: 2 hours**

IMPORTANT INSTRUCTIONS

- This paper contains **four (04)** questions on five (05) pages.
- The medium of this examination is **English.**
- This is a **closed-book** examination.
- Each question carries **equal 100** marks.

Question 01 **[100 marks]**

a) Distinguish three (03) main differences between IPv4 and IPv6 addresses. [12 marks]

b) Identify the class of the following IP addresses. [12 marks]

i) 11100001 11100101 01110011 10110000
ii) 01011000 01110111 10010001 11101000
iii) 168.212.226.204
iv) 190.60.152.25

c) A "Falcon" is a company which has four departments named Finance, Marketing, Production and Research and Development (R & D). The IP address block of the company is given as **220.86.76.0 / 26**. Assume that each department should have its own separate network and the same number of hosts per network.

[34 marks]

i) How many network bits are available according to the given IP address block?

ii) What is the subnet mask?

iii) Identify the number of subnets according to the above given scenario.

iv) Calculate the number of usable hosts per subnet.

v) State the network address, broadcast address, first usable IP address and last usable IP address of the each subnet.

d) The "Falcon" company has a separate institute for offering certificate and diploma courses which are related to the Information Technology (IT). This institute has three laboratories with different number of computers. The IP address block of the institute is given as **220.60.80.0 / 24**. Assume that each laboratory has its own subnet and different number of hosts per network as well as there should be a minimum wastage of IP addresses. The more details of the laboratories are as follows.

Lab A – 45 hosts
Lab B – 25 hosts
Lab C – 10 hosts

Calculate the subnet mask, network id, first usable IP, last usable IP and broadcast IP addresses per each subnet using **unequal subnetting.**

[42 marks]

Question 02 **[100 marks]**

a) Briefly discuss three (03) characteristics of routing algorithm relevant to the computer network.

[15 marks]

b) Consider the following given topology (Figure 1) with eight routers (A, B, C, D, E, F, G and H) and relevant weights (distances). Apply **Link State Routing Algorithm** to the given topology and answer the following questions accordingly.

i) Find the shortest path from router **A** and give your steps in a table.

[36 marks]

ii) Sketch the given topology again according to the part (i).

[14 marks]

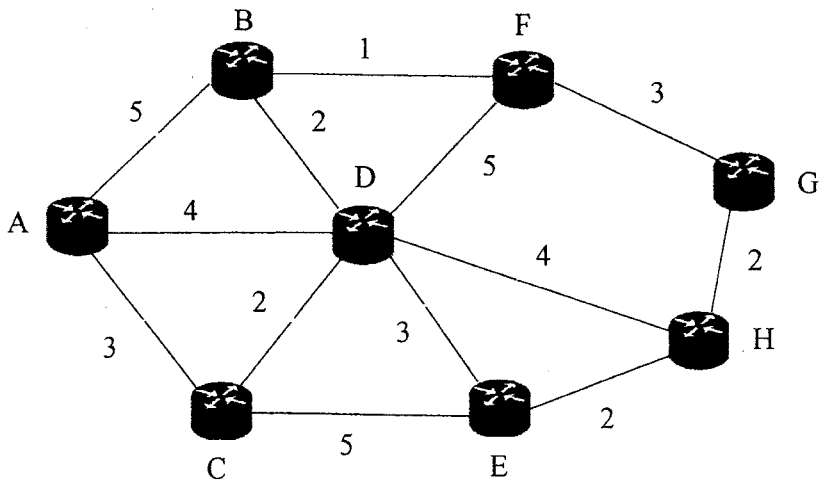

Figure 1

c)

i) Write down three (03) factors which is caused to create a congestion situation in a network.

[9 marks]

ii) Distinguish the main difference between Choke Packet and Explicit Signaling mechanisms in congestion control.

[10 marks]

iii) Briefly describe the Leaky Bucket Algorithm in congestion control.

[16 marks]

Question 03 **[100 marks]**

a) The Data Link Layer can provide services to the network layer such as framing, flow control and error control. The framing is a mechanism to breakdown a stream of bits into smaller, digestible chunks called frames.

i) Indicate the structure of a frame with brief explanation.

[12 marks]

ii) Byte Stuffing is a mechanism to recognize the starting and ending boundaries of a frame. Consider the following dataset which is ready to transmit to the receiver's end. Rewrite the dataset again after performing the **Byte Stuffing** mechanism on them.

[12 marks]

A. | X | FLAG | Y |

B. | X | ESC | ESC | Y |

b) Error detection methods are used to detect the errors during the transmission. Consider the following given dataset which is transmitted from sender to receiver.

11011001111011010101110110010010

i) Longitudinal Redundancy Checks (LRC) adds a new character block to the original dataset during its transmission. Estimate the **LRC character block** of the above given dataset.

[10 marks]

ii) Consider the above given dataset which is sent from source to destination. Find the **checksum** and verify that there is no error in receiver's end.

[18 marks]

c) R.W. Hamming was introduced the method called **"Hamming code"** which is used to error control during the network transmission. Consider the 7-bits hamming code to answer the following questions.

i) Indicate the structure of the 7-bits hamming code word.

[7 marks]

ii) The data bits of 7-bits hamming code word is given as **1010**. Estimate all the parity bits and find the 7-bits hamming code word accordingly. Assume the even parity and state whether the received code is correct or incorrect.

[24 marks]

iii) Hamming code is not only used for the purpose of error detection. It is used to correct that detected errors. Suppose a 7-bits hamming code is received to the receiver's side as **1001101**. Assume the even parity and identify the received code as incorrect. Find the error bit position in the received code.

[17 marks]

Question 04 **[100 marks]**

a)

i) As computer networks grows in size and complexity, the internetworking devices are used to connect them together. Give four (04) examples of the internetworking devices.

[8 marks]

ii) Briefly explain Layered Communication using real world example.

[10 marks]

b) Consider a noiseless channel which has a bandwidth of 50 kHz assigned for data communication. It needs to send 200 kbps over the channel. **Using Nyquist Theorem,** calculate the number of signal levels which are needed for the data transmission.

[18 marks]

c)

i) Briefly discuss the differences between Unshielded Twisted Pair (UTP) cable and Shielded Twisted Pair (STP) cable according to the criteria given below.

A. Data rate
B. Cable length
C. Easiness of installation
D. Cost

[16 marks]

ii) Write down three (03) transmission ways of unguided media signals from source to destination and briefly describe two (02) of them.

[10 marks]

d)

i) Briefly explain the process of Multiplexing in data transmission.

[10 marks]

ii) Define three (03) types of Multiplexing and briefly discuss two (02) of them.

[10 marks]

iii) Indicate two (02) protocols for each of the following layers in TCP/IP model.

A. Application layer

B. Transport layer

[8 marks]

iv) Briefly describe the functionality of the Domain Name Server (DNS).

[10 marks]

---------- **End of the Paper**----------