UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACHELOR OF ENGINEERING TECHNOLOGY: *ELECTRICAL*
SUBJECT	:	**Networks 2B**
CODE	:	**NETELB2**
DATE	:	January 2020 (**SUPPLEMENTARY EXAM**)
DURATION	:	3 hours
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

EXAMINER	:	MR. V. RAMESHAR
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NUMBER OF PAGES	:	5 PAGES

INSTRUCTIONS : CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)

INSTRUCTIONS TO CANDIDATES:

1. ATTEMPT ALL THE QUESTIONS,
2. WRITING IS DONE IN PEN ONLY,
3. DO NOT COMBINE ANSWERS TO DIFFERENT SUB-SECTIONS OF QUESTIONS,
4. YOU WILL BE GIVEN 3 HOURS TO COMPLETE THE EXAMINATION,
5. THERE ARE 5 QUESTIONS FOR 100 MARKS,
6. **THE QUESTION PAPER SHOULD RETURN WITH THE ANSWER SHEET.**

Question 1

1. Choose **TRUE/FALSE** for each of the following:

Answer true for a statement which you agree with and false to statements that you disagree with.

1.1. The LLC protocol sits at layer 2 of the OSI model. T/F

1.2. Data encapsulation at the data link layer is the process of creating and adding headers and trailers to the network layer PDUs. T/F

1.3. The framing process provides important delimiters that are used to identify a group of bits that make up a frame. This process provides synchronization between the transmitting and receiving nodes. These delimiters indicate the start and end of the frame. All bits between these two delimiters are a part of the same frame. T/F

1.4. The MAC address is often referred to as a burned-in address (BIA) because it is burned into read-only memory (ROM) on the NIC. This means that the address is encoded into the ROM chip permanently and cannot be changed by software. T/F

1.5. When the source device is forwarding the message on an Ethernet shared network segment, the frame header contains the destination MAC address. Each NIC on a network segment views the information in each frame header to see whether the MAC address matches its physical address. If there is no match, the device discards the frame. T/F

1.6. When a host wants to participate in a multicast group, it uses an application or service to subscribe to the multicast group. This allows Layer 3 to process packets to this address. T/F

1.7. The term CSMA/CD stands for continuous sensing multiple access/collision detection. T/F

1.8. If a collision occurs, the transmitting devices that detect the collision will continue to transmit for a specific period to ensure that all devices on the network detect the collision. This is called the jam signal. T/F

1.9. Network hosts have limited resources, such as memory or bandwidth. When the transport layer is aware that these resources are overtaxed, some protocols can request that the sending application reduce the rate of data flow. This process is called autonegotiation. T/F

1.10. Windows 8 is an operating system that adheres to the OSI model. Previous versions of Windows only adhered to the TCP/IP model. T/F

[10]

Question 2

2.1 Describe the field in the IP header that can be used to ensure that a packet is forwarded through no more than N routers between a source and destination. (2)

2.2 For packet forwarding process at a router, briefly describe the packet scheduling algorithm which ensures that all packets depart in the order in which they arrived? (2)

2.3 Briefly describe the algorithm which would be appropriate for a network environment where one class of packets must be given priority over another class of packets. (2)

2.4 The network layer functionality can be broadly divided into data plane functionality and control plane functionality. Differentiate between data plane and control plane. (4)

2.5 Briefly discuss the principal responsibilities of each of the five layers of the Internet (commonly known as TCP/IP) protocol stack. (10)

2.6 **Define the following terms:**

2.6.1 ARP
2.6.2 CSMA
2.6.3 CRC
2.6.4 DCE
2.6.5 DHCP (5 x 2)

[30]

Question 3

3.1 Suppose you would like to urgently deliver 100 gigabytes data from DFC to APK. You have available a 4 Mbps dedicated link for data transfer. Would you prefer to transmit the data via this link or instead walk from DFC to APK to deliver the data? Explain. (4)

3.2 If a process in Host-C has a UDP socket with port number 9119. Suppose both Host-A and Host-B each send a UDP segment to Host-C with the destination port number 9119. On processing the segments, explain how the process running at Host-C will know that these two segments originated from the two different hosts. (4)

Question 3 continued…

3.3 Assume there are two packet switches and a router between a sending host and a receiving host. The transmission rates between the hosts are R_1, R_2, R_3 and R_3 as illustrated in Figure 1. Assuming the switches and the router use store-and-forward packet switching to relay traffic, determine the general expression for end-to-end delay to send 1000 packets of length *L* each. Ignore the queuing, propagation and processing delays along the path. (3)

Figure 1: Packet switching between through two switches.

3.4 Based on your general expression for the end-to-end delay above, assume that L = 256 bytes, R_1 = 256Kbps, R_2 = 128Kbps, R_3 = 500Kpbs and R_4 = 1Mbps. Calculate the end-to-end delay to send the 1000 packets from the sending host to the receiving host. (4)

3.5 Given that R_1 = 256Kbps, R_2 = 128Kbps, R_3 = 500Kpbs and R_4 = 1Mbps, determine the maximum throughput along the path and briefly evaluate how this is obtained. Describe throughput in this entity. (5)

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Question 4

4.1 Determine the 32-bit binary equivalent of the following IP address: **176.125.26.19**. Show your calculations clearly. (No marks will be awarded without clear calculations.) (4)

4.2 Suppose Host-A, Host-B and Host-C each attach to the same broadcast LAN through their adaptors. If Host-A sends thousands of IP datagrams to Host-B with each encapsulating frame addressed to the MAC address of host-B, will Host-C's adaptor pass the IP datagrams in these frames to the network layer of Host-C? Explain briefly. (4)

4.3 Both UDP and TCP use 1s complement for their checksums. Suppose a host receives the following three bytes of data: [**01010011 01100110 01110100]**. Although TCP and UDP use 16-bit words in computing the checksum, use 8-bit sums to determine the 1s compliment of the sum of the three bytes. Show your work clearly. (6)

4.4 With a clear example, illustrate that two dimensional parity checks can correct and detect a single bit error, and show a double bit error that can be detected but not corrected. (6)

[20]

Question 5

5.1 Consider a router that interconnects three subnets: Subnet-1, Subnet-2 and Subnet-3. Suppose all of the interfaces in each of these three subnets are required to have the prefix **176.16.1./24**. Also, suppose that Subnet-1 is required to support at least 60 interfaces, Subnet-2 is to support at least 90 interfaces, and Subnet-3 is to support at least 12 interfaces. Provide three network addresses of the form **a.b.c.d/x** that will satisfy all these requirements. Show IP address allocation **with the aid of a sketch** for the interfaces on the 3 routers, and in the case of PC1, PC2 and PC3 show the following configuration details: *IP address*, *subnet mask* and *default gateway*.

[20]

Total = 100 = 100%