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(Knowledge for Development)

KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**END OF SEMESTER EXAMINATIONS
YEAR ONE SEMESTER ONE EXAMINATIONS**

**FOR THE DEGREE OF
MASTER OF SCIENCE IN INFORMATION
TECHNOLOGY (IT)**

COURSE CODE : MIT 814

COURSE TITLE : COMPUTER NETWORKS

DATE: 29/05/2021

TIME: 9:00 A.M - 11:00 A.M.

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE [20 MARKS]

- a) When creating a network application, there are technical factors that can determine its successful long-term deployment. For each of the factors listed below define what the factor means in relation to network applications and why it is important.
- i. Quality of Service (QoS) [2 marks]
 - ii. Quality of Experience (QoE) [2 marks]
 - iii. Bandwidth and Throughput [2 marks]
 - iv. Latency and Jitter [2 marks]
- b) Discuss any Three (3) scheduling Techniques commonly used to improve the Quality of Service. [6 marks]
- c) Traffic Shaping is a mechanism used to control the amount and the rate of traffic sent to the network. Explain the two main techniques implemented to shape traffic in a network. [6 marks]

QUESTION TWO [20 MARKS]

- a) Discuss the common causes of network congestion in a typical managed network. [6 marks]
- b) TCP is considered a connection-oriented protocol that reliably control the transfer of data. Explain each of the listed TCP features with regard to this functionality.
- i. Connection management [2 marks]
 - ii. Reliability [2 marks]
 - iii. Flow Control [2 marks]
 - iv. Congestion Control [2 marks]
- c) Describe the conditions necessary for a TCP Slow Start state. [6 marks]

QUESTION THREE [20 MARKS]

- a) There is a proposition that, Design for speed, not for bandwidth optimization. Justify this statement. [2 marks]
- b) Discuss the differences between integrated service and differentiated service. [3 marks]
- c) Consider in a network environment Kenya and Uganda are neighbours. Each has wireless IPv4 routers with integrated NAT. Each neighbour connects their laptop to their own wireless router, and each uses appropriate utilities to examine the IP address of each laptop. As a network architect you decide to integrate Software Defined Networking (SDN) in the design
- i. Identify the layers of the SDN Architecture you will consider. [3 marks]
 - ii. Explain why SDN implementation in this setup could be of importance. [4 marks]

- iii. Explain the benefits of Network Function Virtualization (NFV) to manage this setup. **[4 marks]**
- iv. Discuss any protocol with support for QoS to aid the implementation process. **[4 marks]**

QUESTION FOUR [20 MARKS]

- a) Discuss the Content Delivery Networks (CDN) architecture and key components as it delivered content over HTTP or HTTPS. **[6 marks]**
- b) Explain the reasons why implementing Content Delivery Networks (CDN) in an organization network is beneficial to deliver content such as images, video, html files and JavaScript from a network of distributed systems to end-users. **[6 marks]**
- c) To create a network application, there are protocols/applications that must be considered to maximize its chance of successful long-term deployment. For each of the factors listed below define what the factor means in relation to network applications and why it is important.
 - i. Internet Protocol Television (IPTV) **[2 marks]**
 - ii. Real Time Streaming Protocol (RTSP) **[2 marks]**
 - iii. Real-Time Transfer Protocol (RTP) **[2 marks]**
 - iv. Adaptive Bitrate Streaming (ABR) **[2 marks]**

QUESTION FIVE [20 MARKS]

- a) Applications require Quality of Service (QoS) parameters to be provided by the network over which they are deployed. Possible QoS parameters include reliability, minimum bandwidth guarantees and minimum packet delivery delays. For following applications give, with reasons, the QoS parameters they will and will not require from the underlying network.
 - i. Watching online films **[2 marks]**
 - ii. Interactive voice conversations **[2 marks]**
- b) Networks are fundamentally unreliable. To provide applications with a reliable QoS that gives reasonable network utilization, the transport layer can implement reliability using a sliding window with either a go-back-N or a selective-repeat approach. Outline how these approaches ensure reliability. **[4 marks]**
- c) A transport layer is going to implement reliability over a network that only very occasionally loses data. Discuss the use of the go-back-N and selective-repeat approaches to implementing reliability in this case and, with reasons, state which of the two approaches would be the most efficient. **[2 marks]**
- d) Reliable flow-controlled communication is occurring between two ends of a transport layer connection. The implementation is using sequence numbers for individual bytes.

The source has an unlimited amount of data that is available to send; the sequence number of the first byte is 10. The receiver has a 100-byte buffer which at time zero is empty; the sending end knows this. The propagation delay in each direction along the connection is two and the transmission delay is zero. Assuming that no packets are lost, and the receiving application reads 20 bytes of data at time 10 and 40 bytes of data at time 20, show what packets will be transmitted across the network from time 0 to time 30. For packets from the sender to the receiver show the amount of data that each contains and sequence number of this data. For packets from the receiver to the sender show the window size and the value of any acknowledgement. **[6 marks]**

- e) State why manual configuration is a poor design choice in networking. What are the key characteristics of mechanisms that IP hosts use to autoconfigure themselves? IP hosts uses DHCP and ARP to autoconfigure themselves, what are the similarities and differences of these two mechanisms? **[4 marks]**