(Knowledge for Development)

KIBABII UNIVERSITY
(KIBU)

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS
YEAR ONE SEMESTER ONE EXAMINATIONS

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

COURSE CODE : MIT 814

COURSE TITLE : COMPUTER NETWORKS

DATE: 19/06/2022 **TIME: 2:00 P.M – 5:00 P.M.**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [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) and Quality of Experience (QoE) **[2 marks]**

ii) Differentiated and integrated services **[2 marks]**

iii) Bandwidth and Throughput **[2 marks]**

b) You are subcontracted as a Network Engineer for Safaricom Limited. Why would you recommend traffic shaping over traffic policing in the client corporate backbone network? **[4 marks]**

c) Discuss the following congestion management approaches

i) WFQ **[2 marks]**

ii) CBWFQ **[2 marks]**

iii) LLQ **[2 marks]**

d) Kibabii University is in the process of upgrading its Data Centre from tier 3 to tier 4. How can SDN and NFV be applicable upon realizing the tier 4 implementation? **[4 marks]**

QUESTION TWO [20 MARKS]

a) What is the difference between Network Time Protocol and Precision Time Protocol? **[4 marks]**

b) There are different classes of multimedia applications. For each of the classes listed below describe what it might be used for and the Quality of Service (QoS) requirements that it has.

i) Streamed stored audio/video **[2 marks]**

ii) Streamed live audio/video **[2 marks]**

c) A stream on-demand video is being made available to 100's thousands of subscribers. Outline, with justifications, the application-level network infrastructure that will be needed to successfully provide this. **[4 marks]**

d) Multimedia clients can have very different capabilities, e.g. of screen resolution, and access content via networks with different bandwidths. Describe why this means that a

multimedia client needs to use a protocol like the Dynamic Adaptive Streaming (DASH) protocol and how they use this to obtain content of the appropriate video quality.

[4 marks]

e) An application needs to transfer large amounts of time-critical data over a very reliable (but not 100% reliable) network. The application developer has decided that they want to avoid the complexity of ensuring that all of the data sent is received by getting a colleague to develop a new transport layer protocol that provides the minimal delay/minimal overhead Quality of Service (QoS) needs. Outline an approach that the colleague could use to implement reliability in this new transport layer protocol. You should justify why the approach that you describe ensures minimal delay and minimal overhead. **[4 marks]**

QUESTION THREE [20 MARKS]

a) Differentiate between the following terms

i) Split Horizon and Poison Reverse **[2 marks]**

ii) Hop Count and Administrative Distance (AD) **[2 marks]**

iii) Classless and Classful Routing Protocol **[2 marks]**

b) Discuss the Bellman-Ford equation and the concept of distance vectors in routing of information from source to destination. **[4 marks]**

c) Due to the deficiencies of RIPv1, RIPv2 was developed in 1993 and was equipped with the ability to support subnet information and supports Classless Inter-Domain Routing (CIDR). Discuss the deficiencies of RIPv1and how RIPv2 and RIPng provide a better platform for implementation in a network environment. **[4 marks]**

d) Discuss the following forms of routing

i) Distance vector **[2 marks]**

ii) Link state **[2 marks]**

iii) Path-vector **[2 marks]**

QUESTION FOUR [20 MARKS]

a) Briefly describe the main differences and similarities between routers and switches.

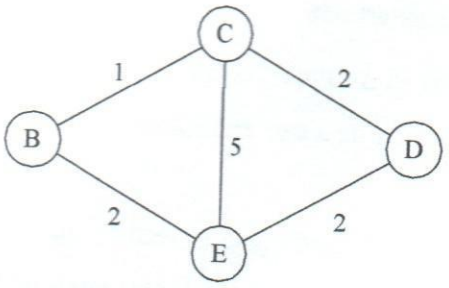
[4 marks]

b) Consider the network shown in the figure below with four nodes. Cost links are shown in the diagram. Give the distance-vector routing tables for node C in the following two consecutive steps.

i) Step 0: C knows the distances to its immediate neighbours and **[3 marks]**

ii) Step 1: information from step 0 is exchanged as per the distance-vector algorithm.

[3 marks]



c) What is the difference between congestion control and flow control in TCP?

[3 marks]

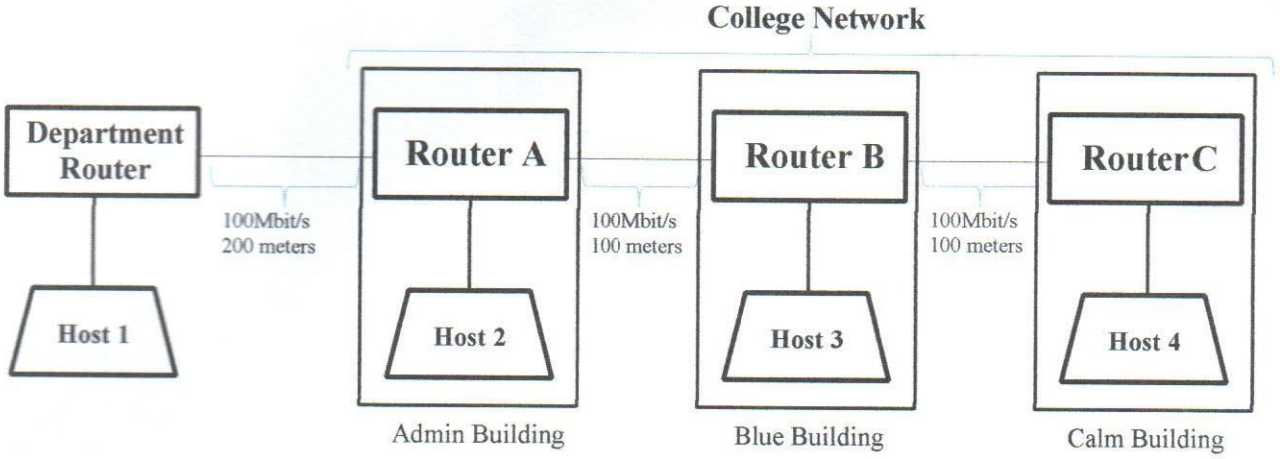
d) Distributing workload and data is a key part of ensuring that network applications are scalable. If the same data is required across the network, caching is one-way of distributing data in a controlled way.

i) Explain how cashing gives scalability. **[3 marks]**

ii) Discuss approaches to ensuring that cached data is up-to-date with the original source of the data. You should include the advantages or disadvantages to each approach that you describe and the situations to which it is best suited.

[4 marks]

QUESTION FIVE [20 MARKS]



a) Using a diagram, illustrate how long a packet of length L bytes will take to travel over an idle network from Host 4 to Host 1? The routers use a store-and-forward architecture.

[5 marks]

b) Computers in Calm building are often not getting allocated IP addresses and the performance is quite poor. The department router serves DHCP for the College network and is operating correctly. Residents in Blue report intermittent performance issues, but no one in Admin reports any problems. Network measurements reveal that the per-router packet loss for each switch under load can be as high as one packet in five thousand, but it is significantly worse for packets smaller than 1000 bytes, where as many as one packet in twenty are lost. With these insights, explain the cause of the problems experienced. Make clear any simplifying assumptions you have made. **[5 marks]**

c) Some students in Calm have found using IPv6 will 'work' (i.e., connecting to the wider University services is possible, but not to Internet services); although still not performing as well as when they are in the Admin building. Describe the steps by which IPv6 addresses are allocated without DHCP and consider why this service may be working more reliably than IPv4? **[6 marks]**

d) Two approaches to improve the network performance are available: one is to upgrade the performance of the physical links between the buildings to 10Gbit/s. The alternative approach is to significantly change the topology of the network by adding an additional high performance router, but leaving the performance of the physical links unchanged. Briefly give the advantages and disadvantages of each approach. **[4 marks]**