

FACULTY	FACULTY OF AGRICULTURE AND NATURAL SCIENCES		
DEPARTMENT	ELECTRICAL AND COMPUTER ENGINEERING		
SUBJECT	COMPUTER NETWORKS		
SUBJECT CODE	I3621CN		
DATE	JUNE 2024		
DURATION	2 HOURS	MARKS	100

FIRST OPPORTUNITY EXAMINATION

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This paper consists of 4 pages excluding this front page.

Instructions

1. Answer **ALL FOUR** questions.
2. The marks allocation for each question are shown
3. Marks for different sections are shown on the right-hand margin
4. Begin each question on a new page
5. Clearly show your work/calculations and sketch good labelled diagrams where required.
6. Calculator/Electronic wristwatch, or any electronics device is not allowed

Question 1: [25 Marks]

(a) SENGATECH is multidimensional engineering organization who just ventured into 4G network driven services and expansion in SADC region. Several modalities are being put in place to ensure smooth running of this organisation. Part of the plan is to have many subsidiaries that can participate in the value chain. One of the plans for SENGATECH is the design and implementation of a robust network infrastructure with combinations of varieties of topologies that enhance smooth operation of the organisation and its subsidiaries.

(i) As a network engineer, explain briefly your understanding of network topology. **[5 Marks]**

(ii) which Network topology will you recommend as the best and most suitable for SENGATECH?

[5 Marks]

(iii) Design a simple network illustration of the topology you recommend in (ii) above. **[5 Marks]**

(iv) State the reason behind your choice of topology for SENGATECH. **[2 Marks]**

(iii) Explain at least four (4) major reasons why you think your suggestion is the most suitable.

[5 Marks]

(iv) Give detailed explanation of three (3) challenges that may be encountered from your recommended topology. **[3 Marks]**

Question 2: [25 Marks]

(a) A computer engineer and specialized developer is building an application that gives Namibians the ability to transfer fund to other countries and view bank account from multiple sources in a single dashboard. The developer has automated the process to retrieve bank customers credentials and validate both sender and receiver from various sources. The process invokes some computer network rules and functions that is associated with several networking resources. The software solution was able to communicate across various other platforms and devices beyond Namibia independent of the operating system.

(i) As a trained computer network engineer. What network resource and component do you think could be responsible for this experience? Justify your answer accordingly. **[8 Marks]**

(ii) Complete the information in the table below by Identifying at least a protocol used in each of the OSI model layer specified in the table. **[7 Marks]**

Layer number	Layer name	Protocol Data Unit (PDU)	Examples of protocols and standards
7	Application	Data received or transmitted by an application	
6	Presentation	Data formatted for presentation	
5	Session	Data passed to the network connection	
4	Transport	TCP segments, UDP datagrams	
3	Network	Packets	
2	Data Link	Frames	
1	Physical	Bits	

- (c) Complete the information in the table below by stating the functions of the following network commands. **[5 Marks]**

SRN	Networking Commands	Functions
1	Ping command	
2	Ipconfig	
3	Traceroute	
4	ipconfig/all	
5	Nslookup	

- (di) Explain the term Cyber Security? **[2 Marks]**

- (dii) Define cryptographic network protocols and explain at least three (3) of its functions. **[3 Marks]**

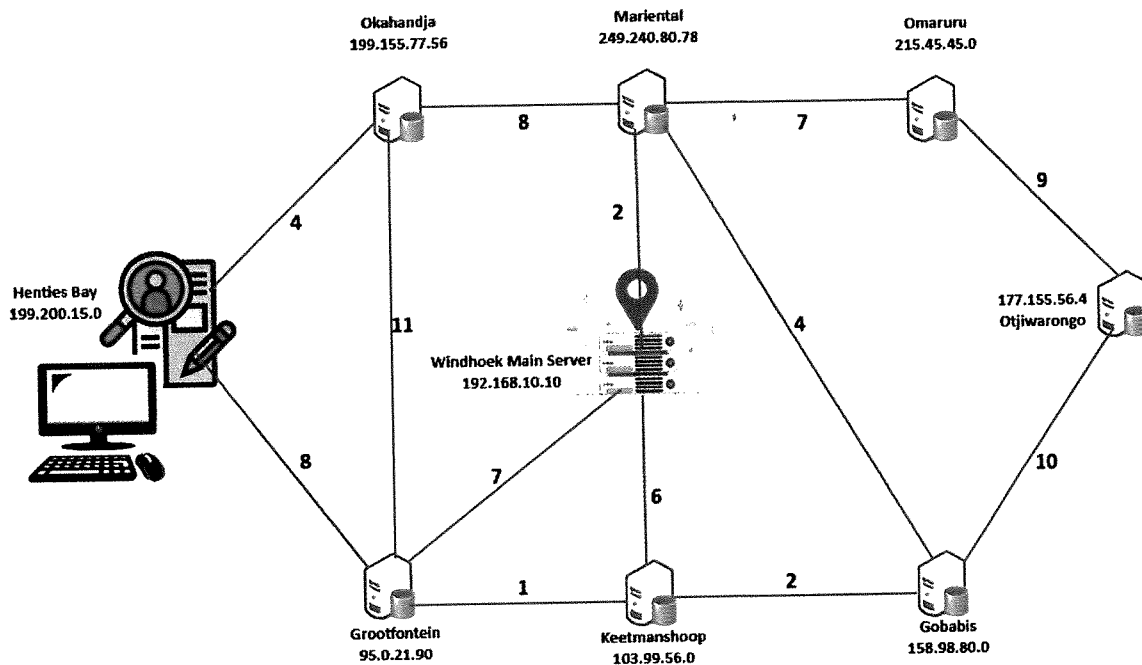
Question 3: [25 Marks]

- (a) UNAM recently advertised a readiness programme open for all students globally with limited application time and space for students. Applicants are requested to complete the online application form emanating from various locations which can be routed through different servers and paths to reach the designated UNAM server located in Windhoek as indicated in the diagram below. UAANDJA has brother who is applying from Henties Bay using his personal computer.
- Describe the concept associated with this scenario with respect to computer networks.
 - What is the networking device responsible for this computer network concept?
 - Identify all possible paths and the applicant's shortest paths to complete his application. Indicate clearly the necessary details in your answers.

(iv) list the various server locations and show the classes of IP address of all the nodes including that of UAANDJA's brother.

(v) what are the metrics that determine the actions performed on the network to provide the best and shortest path for UAANDJA's brother to complete his UNAM readiness application.

[10 Marks]



(b) (i) The following IP addresses and subnet masks belong to a set of nodes/terminals within a typical network. Convert them to a decimal equivalent and identify the classes of IP for each of them. (Show all your workings clearly).

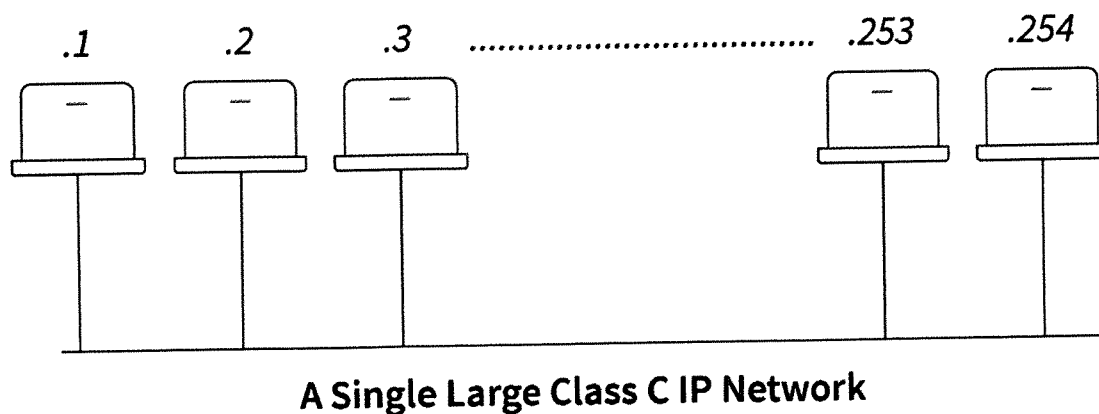
[6 Marks]

Node 1 IP: 10101100.10101000.00000001.00000001
Subnet Mask: 11111111.11111111.00000000.00000000

Node 2 IP: 11000000.10101000.00000001.00000001
Subnet Mask: 11111111.11111111.11111111.00000000

Node 3 IP: 11000000.10101000.00000001.00000001
Subnet Mask: 11111111.11111111.11111111.11110000

(C) A university has four departments: Computer Engineering, Mechanical, Civil and Electrical Engineering. There are 50 students in each department. The institution used a private class C IP network (with network ID 192.168.1.0). All computers are currently working in a single huge network as illustrated below. It becomes complex for the institution administrator to handle tasks on the network.



- (i) What do you think is the solution to solve this type of problem. **[4 Marks]**
- (ii) Redesign the network of the university using appropriate network solution recommended in (i) and State a few merits and demerits of your new network design. **[5 Marks]**

Question 4: [25 Marks]

- (ai) Explain Link State Routing Protocol with respect to Dijkstra's Algorithm. **[5 Marks]**
- (a ii) Write a code snippet to illustrate the algorithmic flow of Dijkstra's Algorithm in your own understanding. **[10 Marks]**
- (b) You are designing a network topology for the newly developed student HOSTELS in engineering campus. Your design is linearly placed in each of the blocks independent of each other. You further designed in such a way that CSMA (Carrier Sense Multiple Access) is used for collision mitigations. Use a diagram to illustrate your network design for the hostel. **[5 Marks]**
- (c) NAMPOWER is upgrading her infrastructures to catch up with the 21st century power generation, transmission and distribution facilities. Driven by updated emerging network technologies including artificial intelligence and machine learning by implementing a third-generation SCADA system. This is to improve the overall efficiency of their power network and optimization. In addition to this improvement coupled with the widespread of renewable energy sources; NAMPOWER also plan to integrate the Rosh Pinah PV Power Plant and other plants within Namibia into the SCADA system.
- (i) Highlight at least three (3) other types of SCADA System implementation aside from the one proposed by NAMPOWER. **[2 Marks]**
- (ii) Design the architecture and briefly describe the choice of SCADA system proposed by NAMPOWER. **[3 Marks]**