nAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY
FACULTY OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE (COMMUNICATION NETWORKS)	
QUALIFICATION CODE: 08 BCHC	**LEVEL:** 6
COURSE: DISTRIBUTED SYSTEMS	**COURSE CODE:** DTS620S
DATE: NOVEMBER 2019	**SESSION:** THEORY
DURATION: 2 HOURS	**MARKS:** 70

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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THIS QUESTION PAPER CONSISTS OF 2 PAGES
(Excluding this front page)

INSTRUCTIONS

1. Answer ALL the questions.
2. Write clearly and neatly.
3. Begin each question on a new page.
4. Number the answers clearly as per the question paper numbering.
5. Marks/Scores per question paper are given in [ ].
6. NUST examination rules and regulations apply.

PERMISSIBLE MATERIALS

1. Scientific Calculator

Question 1

(a) Identify any two examples of resources that can be shared in distributed systems and explain how they can be shared [4 marks].

(b) Given a wide area network for Okamatapati Region in Figure 1, present the routing tables for the region's network, given that the routing algorithm in use is the RIP summarized by the pseudo-code below [10 marks].

> *Send:* Each *t* seconds or when *Tl* changes, send *Tl* on each non-faulty outgoing link.
> *Receive:* Whenever a routing table *Tr* is received on link *n*:
> for all rows *Rr* in *Tr* {
> if (*Rr.link* | *n*) {
> *Rr.cost* = *Rr.cost* + 1;
> *Rr.link* = *n*;
> if (*Rr.destination* is not in *Tl*) add *Rr* to *Tl*;
> // add new destination to *Tl*
> else for all rows *Rl* in *Tl* {
> if (*Rr.destination* = *Rl.destination* and
>   (*Rr.cost* < *Rl.cost* or *Rl.link* = *n*)) *Rl* = *Rr*;
> // Rr.cost < Rl.cost : remote node has better route
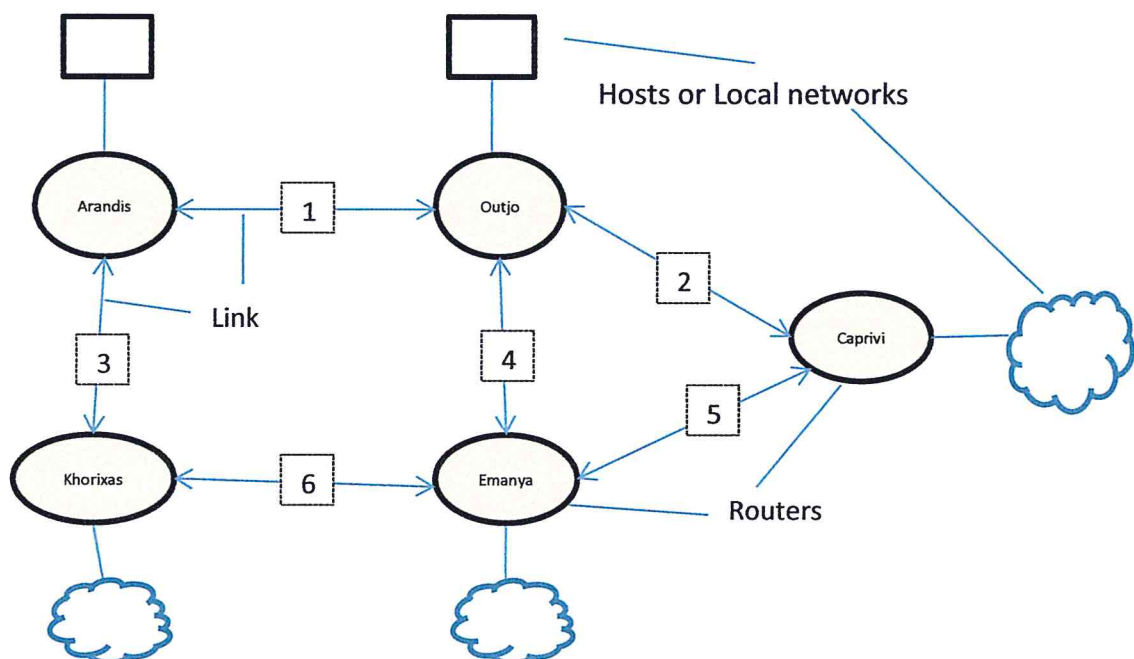> // Rl.link = n : remote node is more authoritative
> }
> }
> }

Figure1: Okamatapati Region WAN.

(c) There are both external and internal reasons many distributed algorithms use time. By giving examples identify any two external reasons and one internal reason [6 marks].

Question 2

    (a) What are the differences between communicating entities and communication paradigms? *[4 marks]*.

    (b) Explain the major differences between RPC and RMI *[4 marks]*.

    (c) Total ordered multicasts encounter the stabilization problem. Can you explain this notion of the stabilization problem citing a practical distributed system setting? *[4 marks]*.

    (d) Expand on the key design choices in distributed file systems relating to caching, consistency and naming *[4 marks]*.

    (e) With the aid of practical examples, explain what you understand regarding security threats faced by modern distributed systems *[4 marks]*.

Question 3

    (a) You are given these four techniques (**caching, replication, functional decomposition and load balancing**), explain how you will use each of these techniques to achieve distributed systems scalability *[8 marks]*.

    (b) Explain what is meant by distributed transparency *[4 marks]*.

    (c) Explain the role of middleware in a distributed system *[4 marks]*.

    (d) Highlight and expand on any two pros of passive replication compared to active replication *[4 marks]*.

Question 4

    (a) Why is openness of a computer system a major characteristic of distributed system design *[6 marks]*.

    (b) Using the Healthcare system as an example for monitoring patients' vital signs such as blood pressure and any chronic illnesses, explain the relationship between mobile computing and ubiquitous computing *[4 marks]*.

*****End of Examination Paper*****