



PAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMPUTING AND INFORMATICS
DEPARTMENT OF SOFTWARE ENGINEERING

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE	
QUALIFICATION CODE: 07BCMS, 07BAIT	LEVEL: 6
COURSE: DISTRIBUTED SYSTEMS AND APPLICATIONS	COURSE CODE: DSA612S
DATE: JAN 2024	PAPER: THEORY
DURATION: 3 HRS	MARKS: 100

SUPPLEMENTARY / SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Ms. NDINELAGO NASHANDI
MODERATOR:	PROF JOSE QUENUM

THIS QUESTION PAPER CONSISTS OF 3 PAGES
(Including this front page)

INSTRUCTIONS TO STUDENTS:

1. Read all the questions, passages, scenarios, etc., carefully before answering.
2. Answer all the questions.
3. Number each answer clearly and correctly.
4. Write neatly and legibly.
5. Making use of any crib notes may lead to disqualification and disciplinary action.
6. Use the allocated marks as a guideline when answering questions.
7. Looking at other students' work is strictly prohibited.
8. This paper consists of four **(4)** pages including the cover page.

SECTION A: 68 marks

- *Answer all the questions in the provided booklet.*
- *The section consists of 11 questions.*

1. List and explain the key characteristics of Distributed Systems? [6 marks]
2. List and explain the three techniques used in failure handling in Distributed Systems. [6 Marks]
3. Compare and contrast replication and partitioning in distributed systems, discussing their purposes, benefits, and challenges. [8 marks]
4. List and describe the two common caching strategies (cache update policy) used in DFS. [6 marks]
5. Differentiate between subscription flooding and filter-based event routing models in a publish-subscribe system. [6 marks]
6. Explain and describe Remote Procedure call (RPC).[5 marks]
7. List and explain the three Call semantics in Remote Procedure call (RPC). [6marks]
8. Discuss the functionality and significance of the RPC (Remote Procedure Call) Interface Definition Language (IDL) like protocol buffer and compiler in facilitating distributed system communications. [6 marks]
9. Present the architecture of a Google File System (GFS) [8 marks]
10. Discuss GFS high availability [3 marks]
11. Explain how a client read operation is performed in GFS (Google file Systems).[8 marks]

SECTION B: 32 marks

- Answer all the questions in the provided booklet.
- The section consists of 4 questions.

1. Discuss the key components and their roles in the Berkeley Algorithm, including the master timekeeper and slave nodes. How do they cooperate to adjust system clocks? [6 marks]
2. Briefly explain the difference between logical and physical clocks. Why it is difficult to synchronize physical clock? [2+3]
3. Outline three techniques for synchronizing physical clocks. [12 marks]
4. At 10:27:540 (hr, min, 1/100 sec.), server B requests time from the time-server A. At 10:27:610, server B receives a reply from timeserver A with the timestamp of 10:27:375.
 - a) By using Cristian's algorithm, to what value should the time be set on the server B clock? [5 marks]
 - b) Find out the drift of B's clock with respect to the time-server A's clock (assume there is no processing time at the time-server for time service). [2 marks]
 - c) Is B's clock going too fast or too slow? If the answer is yes, by how much is the clock going too fast or too slow? [2 marks]

***** End of the Paper *****

