# PAN AFRICA CHRISTIAN UNIVERSITY

**BACHELOR OF SCIENCE INFORMATION TECHNOLOGY**

**END OF TERM EXAMINATION**

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| **DEPARTMENT:** | **COMPUTING & INFORMATION TECHNOLOGY** |
| **COURSE CODE:** | **BCIT306** |
| **CAMPUS:** | **ROYSAMBU** |
| **COURSE TITLE:** | **DISTRIBUTED SYSTEMS** |
| **EXAM DATE:** | **DD MM 2024** |
| **TIME:** | **START _____HOUR _____ END HRS** |

**INSTRUCTIONS**

- This exam script has **TWO (2)** sections.
- Read all questions carefully before attempting.
- Answer All questions in Section **A** and any other THREE questions in Section **B.**
- None programmable calculators permitted
- Calculators on phones, tablets and computers are NOT permitted in Theory Papers


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**SECTION A**
**(Answer ALL questions in this section)**

**QUESTION ONE**

A technology startup is developing a Distributed Ride-Sharing System (DRSS) similar to Uber or Bolt. The system consists of multiple driver and passenger applications that interact through a distributed backend. The system relies on multiple distributed technologies, including remote procedure calls (RPC), web services, and peer-to-peer (P2P) communication, to efficiently match riders with drivers.

a) Justify the suitability of distributed architecture for a ride-sharing system like DRSS **(2 Mark)**
b) Explain why DRSS should integrate web services for real-time traffic data instead of relying on its own database **(2 Mark)**
c) Identify two challenges that DRSS may face as a distributed system and suggest a possible solution for each. **(4 Marks)**
d) Explain how process synchronization is critical in assigning a driver to a passenger in DRSS. **(2 Marks)**
e) Describe a scenario where an RPC failure could affect ride matching in DRSS and suggest a mitigation strategy. **(3 Marks)**
f) The DRSS system must send real-time updates (such as driver location) to passengers. Should it use message passing or RPC? Justify. **(2 Marks)**

**SECTION B**
**(Answer any THREE (3) questions in this section)**

**QUESTION TWO**

A company is developing a Distributed Online Food Delivery System (OFDS) similar to Uber Eats or Glovo. The system connects customers, restaurants, and delivery riders


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through a distributed architecture to facilitate food ordering, payment, and real-time delivery tracking.

a) Explain two advantages of using a distributed approach in the case study above. **(4 Marks)**

b) The OFDS system involves multiple distributed processes. Identify three processes running in the system **(3 Marks)**

c) The OFDS uses Remote Procedure Calls (RPC) to check for available delivery riders. Explain how RPC works in this context and why it is preferred over traditional HTTP requests. **(4 Marks)**

d) Suppose an RPC call from the order management process to the payment process fails. Identify two possible causes of this failure and suggest a solution for each.

**(4 Marks)**

**QUESTION THREE**

a) Describe any THREE similarities found between RPC and RMI as used in distributed systems **(6 Marks)**

b) Concurrent processing is central to distributed computing; which is efficiently supported by several operating systems concepts and mechanisms. Discuss TWO of these mechanisms for the support. **(6 Marks)**

c) Explain TWO fundamental reasons to implement distributed systems in a microfinance banking institution **(3 Marks)**

**QUESTION FOUR**


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A hospital is developing an Online Healthcare Consultation System (OHCS) to provide remote patient-doctor consultations. The system enables patients to book appointments, consult doctors via video calls, and receive prescriptions through an integrated pharmacy service. It relies on distributed communication mechanisms and web services to ensure real-time interactions between different system components.

a) The OHCS allows real-time video consultations between doctors and patients. Justify a communication model most suitable for this feature **(2 Marks)**

b) The OHCS system must notify patients when their doctor is available for a consultation. Describe three possible communication mechanisms that can be used to send this notification. **(6 Marks)**

c) The OHCS integrates an external pharmacy web service to process prescriptions. Justify the use of a web service over building an in-house pharmacy system **(4 Marks)**

d) If the external pharmacy web service is down, the OHCS should not block the doctor from issuing prescriptions. Describe three possible strategies to handle this failure. **(3 Marks)**

**QUESTION FIVE**

a) Describe the Peer-to-Peer computing paradigm using real-life applications **(3 Marks)**

b) Explain any THREE implications for implementing a threaded computing environment in distributed systems. **(6 Marks)**


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c) Discuss THREE types of distributed computing models **(6 Marks)**

**QUESTION SIX**

A company has developed a Peer-to-Peer (P2P) File Sharing System that allows users to share large files (e.g., videos, software, documents) without relying on a central server. Users can upload files, search for available files, and download them directly from other users in the network.

a) Explain two advantages of using a P2P approach instead of a centralized system. **(4 Marks)**

b) Describe three types of P2P architectures that could be used for this system. **(6 Marks)**

c) In P2P systems, bandwidth usage is a critical concern. Suggest THREE techniques to optimize bandwidth usage in the file-sharing process. **(3 Marks)**

d) A common challenge in P2P networks is the presence of malicious users sharing corrupted or harmful files. Suggest two strategies to prevent users from downloading malicious files. **(2 Marks)**

**End of Exam**

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