PAN AFRICA CHRISTIAN UNIVERSITY

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

END-OF-TERM EXAMINATION

DEPARTMENT:	**COMPUTING & INFORMATION TECHNOLOGY**
COURSE CODE:	**BSIT410**
CAMPUS:	**ROYSAMBU**
COURSE TITLE:	**BLOCKCHAIN TECHNOLOGY**
EXAM DATE:	**DAY OF WEEK, DATE (DDTH MONTH YEAR)**
TIME:	**START HOUR – END 13:00-17:00 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.**
- Write only your **student number** on the answer booklet provided.
- None programmable calculators permitted
- Calculators on phones, tablets and computers are NOT permitted in Theory Papers

SECTION A
(Answer ALL questions in this section)

Question 1

A consortium of hospitals and clinics has launched HealthChain, a blockchain-based system to securely store and share patients' medical records across different healthcare providers. HealthChain uses a public blockchain and aims to ensure data privacy, security, and transparency for patients and healthcare providers. Smart contracts are used for managing patient consent and insurance claims.

a) Briefly explain how blockchain ensures data integrity in the HealthChain project. **(2 marks)**
b) Identify a suitable consensus protocol for HealthChain and justify your choice in one sentence. **(2 marks)**
c) List two key use cases of blockchain in the HealthChain system. **(2 marks)**
d) HealthChain uses hashing to protect patient data. Name one hashing algorithm typically used in blockchain and its purpose. **(2 marks)**
e) Explain in one sentence why HealthChain might use Ethereum for its blockchain implementation. **(2 marks)**

QUESTION 2

A multinational company has implemented a Blockchain-Based Supply Chain Management System to enhance transparency, traceability, and security in the movement of goods from manufacturers to retailers. The system ensures that all transactions, including product manufacturing, shipping, and delivery, are recorded on a blockchain. To maintain data integrity and prevent fraud, the system uses a consensus protocol to validate transactions before they are added to the blockchain. The company is evaluating different consensus mechanisms, including Proof of Work (PoW), Proof of Stake (PoS), and Practical Byzantine Fault Tolerance (PBFT), to determine the most efficient approach.

a) Explain the importance of a consensus protocol in a blockchain-based supply chain system **(2 Marks)**
b) Justify a suitable consensus mechanism for a supply chain blockchain in the above case study **(3 Marks)**
c) Explain two challenges of using Proof of Work (PoW) in a supply chain management system. **(2 Marks)**
d) The company is exploring Practical Byzantine Fault Tolerance (PBFT) for validating supply chain transactions. State three advantages of using PBFT over PoW **(3 Marks)**

QUESTION 3

A group of agricultural cooperatives launched **AgriChain**, a blockchain-based platform to track the movement of farm produce from farmers to retailers. AgriChain uses **smart contracts** to automate payments to farmers, ensure transparency in produce quality, and to track supply chain data. To maintain network trust, it uses a consensus protocol suitable for the agricultural community's needs.

a) State the primary purpose of a consensus protocol in the AgriChain blockchain **(2 Marks)**
b) Name one advantage of using a consensus protocol in AgriChain and explain it in one sentence. **(2 Marks)**
c) List two specific use cases of blockchain in AgriChain's supply chain tracking system. **(2 Marks)**
d) Explain how AgriChain's smart contracts help improve transparency for retailers and consumers. **(2 Marks)**
e) Identify TWO ways in which blockchain can help AgriChain farmers get paid faster. **(2 Marks)**

QUESTION 4

A government agency is implementing an Ethereum-based Digital Identity Management System to provide citizens with secure, verifiable, and decentralized identity records. The system uses Ethereum smart contracts to store identity details, allowing individuals to control their personal data while enabling authorized institutions (e.g., banks, healthcare providers) to verify identities securely. To ensure efficiency and transparency, the system utilizes Ethereum's blockchain, smart contracts, and token standards to facilitate secure identity verification and authentication without relying on a central authority.

a) Justify the suitability of Ethereum as blockchain for implementing a digital identity management system **(2 Marks)**
b) Explain how Ethereum ensures the security and immutability of stored identity records **(3 Marks)**
c) Describe how Ethereum smart contracts enhance trust in digital identity verification **(3 Marks)**
d) Explain why an Ethereum-based identity system might use ERC-721 tokens instead of ERC-20 tokens **(2 Marks)**

QUESTION 5

a) Describe the role of EVM in distributed application development **(4 Marks)**
b) Highlight any THREE methods required in ERC-20 specifications **(6 Marks)**

QUESTION 6

EduCert is a blockchain-based system developed by a consortium of universities to securely store and share student academic records and certifications. The goal is to eliminate fake

certificates, provide tamper-proof verification, and streamline record sharing with employers. EduCert uses Ethereum as its blockchain platform and employs smart contracts to automate certificate issuance and verification processes.

a) State the role of cryptographic hashing in EduCert's blockchain system **(2 marks)**
b) Explain the concept of "immutability" in the context of EduCert. **(2 marks)**
c) Identify one benefit of using a decentralized network in EduCert's blockchain system. **(2 marks)**
d) State one feature of Ethereum that makes it suitable for the EduCert project. **(2 marks**)
e) Define "gas" as used in EduCert's blockchain **(2 marks)**

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