Centurion University
Shaping Lives... Empowering Communities...

School: ..... Campus: .....

Academic Year: ..... Subject Name: ..... Subject Code: .....

Semester: ..... Program: ..... Branch: ..... Specialization: .....

Date: .....

Classroom Learning

(Learning by Listening and Observations)

Name of the Topic: Mining of Cryptocurrencies

Learning Outcome:

Concepts learned (Mention 2/3 principles):

Based on the classwork, the principal concepts I have learned include:

1. The fundamental concept of mining as the process of validating new transactions and recording them on the global public ledger (blockchain).
2. The complete architecture of the Proof-of-Work (PoW) consensus mechanism, which requires miners to solve complex cryptographic puzzles to add a new block.
3. The characteristics of a mining ecosystem, including miners, mining pools, hardware (ASICs, GPUs), and the role of difficulty adjustment in maintaining block time.

* New techniques learned:

Additionally, I have acquired new knowledge in the following areas:

1. Techniques for how a miner selects transactions from the mempool, verifies their legitimacy, and assembles them into a candidate block.
2. Procedures for understanding the cryptographic hash function (SHA-256 in Bitcoin) and the "nonce" value that miners vary to find a valid block hash below the target difficulty.
3. The process of how the network difficulty adjusts periodically based on the total computational power (hash rate) to ensure a consistent time between blocks.
4. Methods for how mining pools operate, combining the hash power of multiple miners to increase the chance of earning a block reward, which is then distributed proportionally.

* Related Project/Practice work experienced and learned:

During the practice sessions of the lab work, I engaged in and developed proficiency with programs and simulations in the following areas:

1. Writing a basic Python program to simulate the core concept of mining by repeatedly hashing block data with a changing nonce to find a hash with a specific number of leading zeros.
2. Calculating the profitability of mining by factoring in hardware cost, hash rate, power consumption, electricity cost, and current network difficulty.
3. Analyzing real blockchain data from explorers like Etherscan to study the size, reward, and transaction count of recently mined blocks.
4. Setting up a node on a testnet to observe the propagation of a newly mined block through the peer-to-peer network.

---

* New Software/Machine/Tool/Equipment/Experiment learned:

During the lab session, I used **Geth (Go-Ethereum)** to sync with a testnet and observe the mining process. I also used online mining simulators and profitability calculators like CryptoCompare or WhatToMine to understand the economic factors involved.

* Application of concept(s) (preferably real life scenario):

1. **Network Security:** The computational work required for mining makes it extremely expensive to attack the network (e.g., execute a 51% attack), thereby securing the blockchain against fraud.
2. **Currency Issuance:** Mining is the decentralized mechanism through which new units of a cryptocurrency (like Bitcoin) are created and introduced into the circulating supply, acting as an incentive for miners.
3. **Transaction Finality:** Once a transaction is included in a mined block and subsequent blocks are added on top, it becomes computationally irreversible, providing certainty to participants.

---

* Case Studies/Examples:

1. **Bitcoin Mining Farms:** Large-scale operations, often located in regions with cheap electricity like Iceland or certain parts of the US and China, dedicate warehouses of ASIC miners to secure the Bitcoin network and earn block rewards.
2. **The Shift to Proof-of-Stake:** Ethereum's "Merge" upgrade replaced mining (PoW) with staking (PoS), primarily to reduce the immense energy consumption associated with mining, showcasing the evolution of consensus mechanisms.
3. **Alternative Consensus Mechanisms:** Cryptocurrencies like Chia use "Proof-of-Space-and-Time," which relies on allocating unused hard drive space rather than computational power, offering a more energy-efficient alternative to traditional mining.

Assessment:

Marks Obtained: ..... / 10

Signature of the Student:

Name : PN Archana

Regn. No. : 240720100147

Signature of the Faculty:

**As applicable according to the topic.*
One sheet per topic (10-20) to be used.