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

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

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

Date: ....

Applied and Action Learning

(Learning by Doing and Discovery)

Name of the Experiement : Build the Network – Peer-to-Peer Simulation

* Coding Phase: Pseudo Code / Flow Chart / Algorithm

1. Network Initialization:
Start by defining the total number of participating nodes (peers) within the decentralized network. Assign each node a unique identifier and initialize an empty ledger or local memory to store incoming transactions and blocks.

2. Establishing Connections:
Form a semi-random mesh topology where each node connects to a selected number of peers, allowing direct communication paths. Maintain a peer list for every node to manage message exchange efficiently and prevent network congestion.

3. Message Propagation:
Designate one node as the initiator to broadcast a transaction or message across the network. Connected peers receive and forward the message to their neighboring nodes (excluding the sender), simulating the message flooding mechanism used in blockchain systems.

4. Verification and Filtering:
Each node independently verifies all incoming messages to ensure authenticity and freshness (i.e., messages that haven't been received before). Any duplicate or tampered messages are discarded, improving efficiency and reducing redundant communication.

5. Ledger Synchronization:
After successful validation, the verified message or block is added to the node's ledger, ensuring consistent data replication throughout the network. This step reflects how blocks are propagated and synchronized across blockchain nodes.

6. Consensus Mechanism (Optional):
To simulate consensus, apply a simple rule such as the **"first valid message received"** principle. Each node accepts the first valid message it receives and rejects any conflicting or delayed data, promoting overall network agreement and consistency.

7. Simulation Output:
Display final results showing the number of nodes that successfully received, validated, and synchronized the message. This output demonstrates how decentralized communication and consensus can occur efficiently without relying on a central authority—capturing the core principle of blockchain's peer-to-peer architecture.

* Softwares used

1. Chrome Web Browser
2. Council

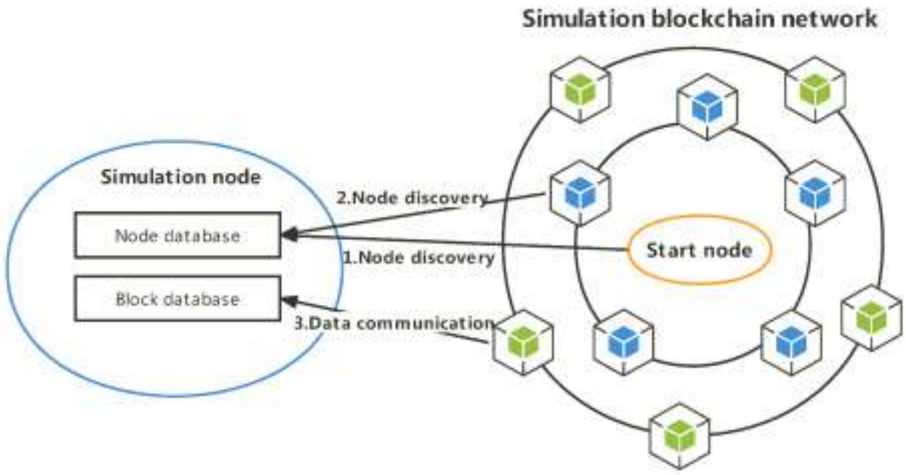
https://www.blockchain-council.org/blockchain/peer-to-peer/

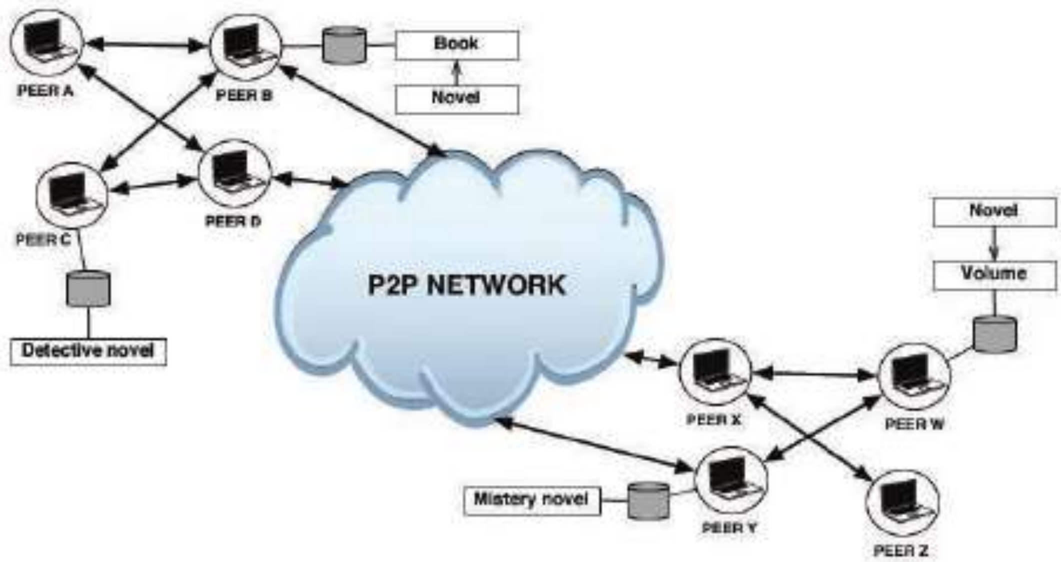
*As applicable according to the experiment.
Two sheets per experiment (10-20) to be used.

* Implementation Phase: Final Output (no error)

Architecture
Peer-to-Peer (P2P) Network

1. A P2P network is a decentralized system where each device (peer) acts as both client and server.
2. It allows direct sharing of files, storage, and power without a central server.
3. All peers have equal authority to send or receive data.
4. Commonly used in online gaming, file sharing, and blockchain systems.
5. Each node maintains its own data and performs similar tasks independently.
6. Unstructured networks connect peers randomly; structured ones follow a fixed pattern.
7. P2P networks offer better scalability, security, and transparency.





*As applicable according to the experiment.
Two sheets per experiment (10-20) to be used.

* Implementation Phase: Final Output (no error)

Build the Network – Peer-to-Peer Simulation
Implementation Phase: Final Output (No Error) – Applied and Action Learning

• **Network Initialization & Node Coordination:**
Simulated a decentralized peer-to-peer (P2P) structure by initializing multiple validator nodes with unique IDs and independent ledgers, ensuring equal participation and realistic communication flow.

• **Message Broadcasting & Validation:**
Implemented a message propagation system where nodes exchange and verify transactions, ensuring integrity, preventing duplication, and achieving synchronized ledger updates across all peers.

• **Consensus & Synchronization Logic:**
Developed a simplified consensus mechanism enabling nodes to accept the first valid message, ensuring uniform data acceptance and demonstrating decentralized coordination without central authority.

• **Performance & Adaptability:**
Optimized node communication and data flow for error-free execution, reflecting scalable, flexible, and future-ready P2P networking principles aligned with real blockchain environments.

* Observations

1. The P2P simulation effectively demonstrated decentralized communication and synchronization without relying on a central server.
2. Message validation and broadcasting processes helped ensure data integrity and consistency across all connected nodes.
3. The simplified consensus model showcased how decentralized systems can achieve agreement efficiently in distributed environments.

ASSESSMENT

Rubrics	Full Mark	Marks Obtained	Remarks
Concept	10		
Planning and Execution/ Practical Simulation/ Programming	10		
Result and Interpretation	10		
Record of Applied and Action Learning	10		
Viva	10		
Total	**50**		

Signature of the Student:

Name :

Regn. No. :

Signature of the Faculty:

***As applicable according to the experiment.*
*Two sheets per experiment (10-20) to be used.***