1. Which features distinguish databases from Blockchain ledgers? Provide a comparative analysis of the two.

Database:

Generally a database is a data structure which is used for storing information. It is a organised collection or storage of data which is able to store a new data or access a existing data. The data stored in a database can be organized using a database management system. The database administrator can modify the data stored in the database. A database is implemented using the client-server network architecture.

Blockchain:

A blockchain is a digital ledger of transactions that are distributed across the entire network of computers (or nodes) on the blockchain. Distributed ledgers use independent nodes to record, share, and synchronize transactions in their respective electronic ledgers instead of keeping them in one centralized server.

Key differences between Blockchain and a Database are:

Database	Blockchain
Database uses centralized storage of data.	Blockchain uses decentralized storage of data.
Database needs a Database admin or Database administrator to manage the stored data.	There is no administrator in Blockchain.
Modifying data requires permission from database admin.	Modifying data does not require permission. Users have a copy of data and by modifying the copies does not affect the master copy of the data as Blockchain is irresistible to modification of data.
Centralized databases keep information that is up-to-date at a particular moment	Blockchain keeps the present information as well as the past information that has been stored before.
Centralized databases are used as databases for a really long time and have a good performance record, but are slow for ertain functionalities.	Blockchain is ideal for transaction platform but it slows down when used as databases, specially with large collection of data.

Comparative analysis

traditionally paper-based and conventional electronic ledgers were used to manage data that had a centralized point of control. This types of the system require high computing resource and labor to maintain ledgers and also had many points of failure

Points of failure like:

1. Mistakes made during data entry.
2. Manipulation of data could happen which increases the risk of errors.
3. Other participants contributing data to the central ledger will not able to verify the legitimacy of data coming from other sources.

However, DLT allows real-time sharing of data with transparency which gives trust that data in the ledger is up to date and legitimate.

Also Distributed Ledger Technology eliminates the single point of failure which prevents data in the ledger from being manipulations and errors. In DLT, there is no need for a central authority to validate transactions here different consensus mechanisms are used to validate transactions which eventually makes this process very fast and real-time. Similarly, DLT can reduce the cost of transactions because of this process.

Advantages Of Distributed Ledger Technology

1. **High Transparency:** Distributed ledger presents a high level of transparency because all the transaction records are visible to everyone. The addition of data needs to be validated by nodes by using various consensus mechanisms. and if anyone tries to alter or change data in the ledger then it is immediately reflected across all nodes of the network which prevents invalid transactions.

2. **Decentralized:** In a centralized network, there may be a single point of failure and it can disrupt the whole network because of mistakes at the central authority level. But in the case of distributed networks, there is no risk of a single point of failure. because of the decentralized structure trust factor also increases in participating nodes. This decentralized nature of validation reduces the cost of transactions drastically.

3. **Time Efficient:** As this network is decentralized so there is no need for a central authority to validate transactions every time. Hence this time for validation of each transaction reduces drastically. In the case of DLT, transactions can be validated by members of the network itself by using various consensus mechanisms.

4. **Scalable:** Distributed ledger technology is more scalable because many different types of consensus mechanisms can be used to make it more reliant, fast, and updated. Because these many advanced DLT technologies are introduced in the last few years. Such as Holochain, hashgraph are considered to be advanced and more secure versions of Blockchain DLT. Blockchain itself is advanced and secure but DLT provides a way to more advanced technologies.

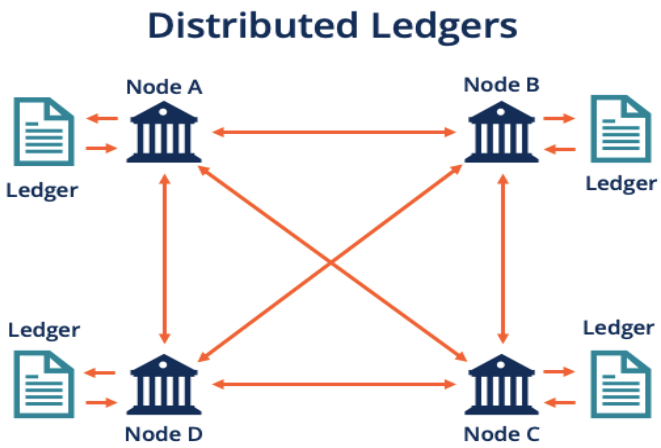
2)Analyse, using a diagram, how a distributed ledger works, present its main characteristics, and explain how it differs from a "traditional" centralized ledger.

Distributed Ledger Technology (DLT) is centered around an encoded and distributed database where records regarding transactions are stored. A distributed ledger is a database that is spread across various computers, nodes, institutions, or countries accessible by multiple people around the globe.

A **distributed ledger** (also called a **shared ledger** or **distributed ledger technology** or **DLT**) is the consensus of replicated, shared, and synchronized digital data that is geographically spread (distributed) across many sites, countries, or institutions

In general, a distributed ledger requires a peer-to-peer (P2P) computer network and consensus algorithms so that the ledger is reliably replicated across distributed computer nodes (servers, clients, etc.)

How Distributed Ledgers Work



Distributed ledgers are held, reorganized, and controlled by individuals called nodes. The database is constructed independently by each node. Every transaction occurring on the network is processed, and a conclusion on the development of the database is created by each node.

Based on the transaction, voting is carried out on the changes completed on the database. All nodes participate in the voting, and if at least 51% of them agree, the new transaction is accepted on the database. Afterward, the nodes update the versions of the database so that all the devices or nodes will be of the same version.

Nodes in Proof-of-Work blockchain are also called miners. When a miner successfully puts a new transaction into a block, they receive a reward. It requires a dedicated 24×7 computer power. It is the responsibility of miners to compute the cryptographic hash for new blocks. Whoever, among the miners, successfully finds the hash first, gets the reward.

Miners dedicating more computational power to find the hash will be more successful. However, as blocks keep generating, it becomes more difficult to find subsequent hash scales. The goal is to keep a constant speed of generating the blocks.

characteristics

1. **Decentralized:** It is a decentralized technology and every node will maintain the ledger, and if any data changes happen, the ledger will get updated. The process of updating takes place independently at each node. Even small updates or changes made to the ledger are reflected and the history of that change is sent to all participants in a matter of seconds.

2. **Immutable:** Distributed ledger uses cryptography to create a secure database in which data once stored cannot be altered or changed.

3. **Append only:** Distributed ledgers are append-only in comparison to the traditional database where data can be altered.

4. **Distributed:** In this technology, there is no central server or authority managing the database, which makes the technology transparent. To counter the weaknesses of having one ledger to rule all, So that there is no one authoritative copy and have specific rules around changing them. This would make the system much more transparent and will make it a more decentralized authority. In this process, every node or contributor of the ledger will try to verify the transactions with the various consensus algorithms or voting. the voting or participation of all the nodes depends on the rules of that ledger. In the case of bitcoin, the Proof of Work consensus mechanism is used for the participation of each node.

5. **Shared:** The distributed ledger is not associated with any single entity. It is shared among the nodes on the network where some nodes have a full copy of the ledger while some nodes have only the necessary information that is required to make them functional and efficient.

Differces from a "traditional" centralized ledger.

Distributed ledger technology has the potential to effectively improve these traditional methods of bookkeeping by updating and modifying fundamental methods of how data is collected, shared, and managed in the ledger. To understand this, traditionally paper-based and conventional electronic ledgers were used to manage data that had a centralized point of control. This types of the system require high computing resource and labor to maintain ledgers and also had many points of failure. Points of failure like:

1. Mistakes made during data entry.
2. Manipulation of data could happen which increases the risk of errors
3. Other participants contributing data to the central ledger will not able to verify the legitimacy of data coming from other sources.

However, DLT allows real-time sharing of data with transparency which gives trust that data in the ledger is up to date and legitimate. Also Distributed Ledger Technology eliminates the single point of failure which prevents data in the ledger from being manipulations and errors. In DLT, there is no need for a central authority to validate transactions here different consensus mechanisms are used to validate transactions which eventually makes this process very fast and real-time. Similarly, DLT can reduce the cost of transactions because of this process.

3)Suggest which type of blockchain should be used for the security of donations in a charity organization. What benefits does the blockchain technology introduce in such a scenario? Explain your answer using an example

Hybrid blockchain perfect for security of donation in charity organization.

Blockchain technology can be leveraged to build a completely transparent charity system by tracking the donations through multiple layers. This would enable donors to track how their funds are spent and ensure they reach the ultimate beneficiaries.

For example there is a **charitable hospital**

If we use hybrid blockchain, which has both the properties of private and public blockchain,some information is visible to all nodes like spending of donation some part is controlled by organization.

51% of proof work easy as it is not fully public blockchain. In public blockchain proof of work is difficult.

Validation of the treatment details, patient details, cost of medicines not required every node involvement in the blockchain. It require some important nodes like Dean, doctor, patient, donor, pharmacist to conform cost of medicine, diagnose lab……. By using hybrid block chain every node will have access to the information but some nodes only have validating power who are necessary for the process.

Transparency

Transactions recorded on blockchain network are immutable and transparent ,which makes it easy for all the parties involved to gain a greater clarity within donation systems. Records linked on a blockchain network can be tracked across the value chain.

Smart contracts

These are digital contracts that runs on computerized transaction protocol supervised by a number of nodes connected to a blockchain network. Since blockchain contracts work on a decentralized system between all permitted parties, it can self-execute and self-maintain thereby eliminating the need for intermediaries such as lawyers or notaries.