

Sample Questions with Answers

Blockchain

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Question 1:

Explain blockchain technology with a simple example of how blocks are connected.

[ANSWER] Answer & Explanation:

Blockchain is a distributed digital ledger that stores data in blocks linked together using cryptographic hashes.

Basic Structure:

Block 1 (Genesis):
- Data: "Alice sends 10 coins to Bob"
- Hash: 0x1a2b3c...
- Previous Hash: 0x000000...

Block 2:
- Data: "Bob sends 5 coins to Charlie"
- Hash: 0x4d5e6f...
- Previous Hash: 0x1a2b3c... (Block 1 hash)

Key Properties:

- Immutable** - Changing any block breaks the chain
- Decentralized** - No single point of control
- Transparent** - All transactions are visible
- Secure** - Cryptographically protected

Simple Example:

Imagine a notebook shared among friends where:

- Each page (block) contains transaction records
- Every page references the previous page number (hash)
- If someone tries to modify an old page, everyone notices because the page numbers do not match
- Everyone has a copy, so no single person can cheat

This creates an unbreakable chain of records that everyone can trust without needing a central authority.

Question 2:

Explain cryptocurrency and its key differences from traditional digital payments.

[ANSWER] Answer & Explanation:

Cryptocurrency is digital money that uses cryptography for security and operates on blockchain networks without central authority.

Traditional Digital Money (Bank Transfer):

- Alice → Bank → Bob
- Bank verifies Alice has \$100
- Bank deducts \$100 from Alice
- Bank adds \$100 to Bob
- Bank maintains central ledger

Cryptocurrency Transaction:

- Alice → Blockchain Network → Bob
- Alice signs transaction with private key
- Network nodes verify signature and balance
- Transaction added to blockchain
- No central authority needed

Key Differences:

Aspect	Traditional Digital	Cryptocurrency
Control	Central bank/authority	Decentralized network
Verification	Bank validates	Network consensus
Reversibility	Can be reversed	Irreversible
Privacy	Bank knows all details	Pseudonymous
Availability	Business hours 24/7/365	Borders Geographic restrictions Global
Fees	Bank fees Network fees	Network fees

Example Cryptocurrencies:

- Bitcoin (BTC)** - Digital gold, store of value
- Ethereum (ETH)** - Smart contract platform
- Litecoin (LTC)** - Faster Bitcoin alternative

Benefits: No intermediaries, global access, programmable money, censorship resistance

Question 3:

Explain the process of creating and verifying digital signatures with an example.

[ANSWER] Answer & Explanation:

Digital signatures use public-key cryptography to prove transaction authenticity without revealing private keys.

Key Generation Process:

- Generate random private key (256-bit number)
Private Key: $d = 0x1234567890abcdef\dots$
- Calculate public key using elliptic curve
Public Key: $Q = d \times G$ (where G is generator point)
 $Q = (x, y)$ coordinates on curve
- Create wallet address from public key
Address = Hash(Public Key)

Transaction Signing Process:

- Create transaction
 $tx = \{ \text{from: "1A1zP1eP5QGefi2DMPTfTL5SLmv7DivfNa", to: "1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2", amount: 0.5, fee: 0.001} \}$
- Hash transaction data
 $txHash = \text{SHA256}(tx) = 0xabc123\dots$
- Sign with private key
 $\text{signature} = \text{sign}(txHash, \text{privateKey})$
- Broadcast transaction + signature

Verification Process:

- Receive transaction + signature
- Hash transaction data
- Verify signature using public key
 $\text{if } (\text{verify}(\text{signature}, txHash, \text{publicKey}) == \text{true}) \{ \text{transaction_valid} = \text{true} \} \text{ else } \{ \text{transaction_invalid} = \text{true} \}$

Security Properties:

- Authentication** - Proves sender identity
- Non-repudiation** - Sender cannot deny signing
- Integrity** - Detects any data tampering
- Unforgeable** - Cannot create valid signature without private key

Real-world Analogy: Like a handwritten signature, but mathematically impossible to forge and can be verified by anyone.

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