Appendix 1:
QUESTIONS AND EXERCISES

Note: The opening chapter does not have questions or exercises

QUESTIONS AND EXERCISES CHAPTER 1

1. What is the difference between symmetric encryption and asymmetric encryption?
2. List the symmetric encryption algorithms and explain how they work?
3. Name asymmetric encryption algorithms and explain why they are often used in information security?
4. What is the block cipher mode?
5. What is the concept of padding in encryption?
6. What is the role of the session key in symmetric encryption?
7. What is a hash function?
8. Which property of a hash function is most important?
9. How is a cryptographic hash function different from a regular hash function?
10. What is the difference between encryption and hashing?
11. Why is hash collision a security problem?
12. How does digital signature work?
13. What is the difference between digital signature and electronic signature?
14. What is the role of hash function in digital signature?
15. What are the common algorithms used in digital signatures?
16. How to verify the validity of a digital signature?
17. How do digital signatures help prevent attacks?
18. Write a program to encrypt and decrypt a message using the AES algorithm. Experiment with different operating modes such as ECB, CBC, and GCM.

19. Write a program to create a hybrid encryption system that uses asymmetric encryption to encrypt the session key and symmetric encryption to encrypt the message.

20. Uses the AES algorithm in ECB mode to encrypt a bitmap image. Observe the results and explain why ECB mode should not be used to encode large structured data such as images.

21. Write a simple program to generate a hash function based on a character string (e.g., using the sum of the ASCII codes). Let's experiment with some different input strings

22. Given a given hash string (e.g.: `d2d2d2...`), find an input string that can generate this hash. Try with popular hash functions like MD5, SHA-1, SHA-256 and record the execution time.

23. Try finding two strings that are different but produce the same hash value using a simple self-written hash function. Compare the results with popular cryptographic hash functions such as MD5 or SHA-1.

24. Write a program to check the integrity of a file using a hash function (for example, SHA-256). Let's change some bytes in the file and observe the change in the hash value.

25. Explain the Birthday attack and write a program that simulates this attack principle on a simple hash function, then implement it with a hash function such as MD5 or SHA-1.

26. Write a simple program that uses the RSA algorithm to create a digital signature for a text string and then verify this signature. Experiment with popular cryptographic libraries like `PyCryptodome` or `OpenSSL`.

27. Uses the ECDSA algorithm to create and verify digital signatures. Compare the performance of ECDSA with RSA when signing the same message.

28. Download a digital certificate from a website (for example, via HTTPS) and write a program to extract the public key from this certificate. Use the public key to verify a digital signature.

29. Research how digital signatures are used in smart contracts on the blockchain platform. Write a simple smart contract that uses digital signatures to verify transactions.

30. Perform a hands-on exercise to create and verify a digital signature using both RSA and ECDSA, then compare signature size, signing speed, and verification speed.

QUESTIONS AND EXERCISES CHAPTER 2

1. What is Blockchain? Let's briefly explain this concept.

2. Outline the important characteristics of blockchain and explain why immutability is the most important factor.
3. What is the consensus algorithm? Compare PoW and PoS.
4. What is a smart contract? Give an example of its application.
5. Describes how blocks are linked together in the blockchain.
6. Who developed the Paxos protocol, which laid the foundation for consensus mechanisms in computer networks?
   a. Satoshi Nakamoto
   b. Leslie Lamport
   c. Stuart Haber
   d. David Chaum
7. What year was the article "Bitcoin: A Peer-to-Peer Electronic Cash System" published?
   a. 1991
   b. 2008
   c. 2009
   d. 2016
8. Which of the following characteristics is not a characteristic of blockchain technology?
   a. Ledger only allows additional entries (Ledger)
   b. Secure with password (Secure)
   c. Centralize management
   d. Distribute and share information
9. What was the first blockchain application?
   a. Ethereum
   b. Bitcoin
   c. NFT
   d. Hashcash
10. In what year was Blockchain officially introduced to the public?
    a. 1989
    b. 1991
    c. 2009
    d. 2016
11. Compare the basic differences between public blockchain and private blockchain.
12. How can hybrid blockchain be applied to the real estate sector? Give an illustrative example.
13. Why is consortium blockchain considered a solution that combines public and private blockchain?
14. Explain why the shutdown of a public blockchain originator does not affect the operation of the network.
15. In your opinion, how does the "less transparency" disadvantage of consortium blockchain affect real-world applications?
16. What is cryptocurrency?
17. How does cryptocurrency work?

18. Name some popular cryptocurrencies.

19. Distinguish between cryptocurrency and fiat money.
Let's present the differences between cryptocurrencies and fiat currencies, especially in factors such as issuance mechanism, control and liquidity.

20. Analyze how blockchain technology ensures the security of cryptocurrency transactions.
Let's explain the security mechanisms that blockchain uses to protect cryptocurrency transactions, including the role of cryptography, consensus mechanisms, and distributed architecture.

21. Research the applications of cryptocurrencies in various industries.
Choose a specific application of cryptocurrency (e.g. decentralized finance - DeFi) and research how it affects that industry. Presents a real-life example of using cryptocurrency in this application.

22. What is Tokenomics?
A simple explanation of tokenomics and its importance in the blockchain ecosystem.

23. Compare the difference between token economics and traditional economics?
Let's explain the main differences between using currencies in the traditional economy and using tokens in blockchain.

24. Bitcoin has several important characteristics in tokenomics. Can you list and explain these characteristics?
Outlines the key factors in Bitcoin's tokenomics and how they affect the value of Bitcoin.

25. Why is predicting the number of tokens in circulation important in blockchain projects?
Analyze the importance of controlling the number of tokens and token distribution plans in cryptocurrency projects.

26. What are NFTs?
Explain the concept of NFTs and the difference between NFTs and fungible assets like cryptocurrencies.

27. Why are NFTs important to artists and content creators?
Let's explain the importance of NFTs for artists and content creators in authenticating ownership and creating value for digital works.

28. NFTs are not divisible, why do some platforms introduce partial ownership?
Analyze why splitting NFTs into smaller pieces is the new trend, and how the Fractional platform has helped the NFT market.

29. Let's give an example of an NFT project on the Cardano platform and how it has grown the NFT ecosystem on Cardano.
Introducing the first NFT project on the Cardano platform and its implications for the development of the NFT ecosystem on Cardano.

30. What factors do NFTs depend on for their value to increase over time?
Analyze how supply and demand factors affect the value of NFTs in the investment market.

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36. What is the biggest challenge of NFTs in the current market? a) Market instability
b) Security of blockchain
c) Artistic value of NFTs
d) Ability to authenticate identity

37. Why are high transaction fees such a big challenge for NFT users? a) High transaction fees only affect the seller
b) Transaction fees reduce returns from investing in NFTs
c) Transaction fees reduce consumer participation and create entry barriers
d) Transaction fees do not affect the development of NFTs

38. How can NFTs help artists in protecting the copyright of their works? a) By allowing artists to reproduce their work as NFTs
b) By helping artists receive direct revenue from NFT sales
c) By allowing artists to sell their work through major companies
d) By devaluing the original work of art

39. What is a wallet in blockchain? Explain the importance of wallets for cryptocurrency users.

40. Distinguish between software wallets, hardware wallets, online wallets and paper wallets. State the advantages and disadvantages of each type of wallet.

41. What role do public and private keys in wallets play in securing digital assets?

42. What impact do cryptocurrency wallets have on trading and managing digital assets like cryptocurrencies or NFTs?

43. Let's explain how wallets work in the blockchain world, especially in signing transactions and securing assets.

44. Lists the security measures the wallet uses to protect user assets.

45. What common security issues and risks should wallet users be aware of when using digital wallets?

46. Why are blockchain addresses important for cryptocurrency transactions?

47. How can smart contracts use blockchain wallet addresses to automatically perform actions?

48. In the NFT ecosystem, what role do wallet addresses play in asset transfers?

49. How can blockchain help manage and store digital assets beyond cryptocurrencies?

50. What is the application of blockchain addresses in DApps and what benefits does it bring to users?

51. What applications can use blockchain to manage personal identities and protect privacy?

52. How are microtransactions on the blockchain implemented and why are they low-cost?

53. What is the function of a blockchain wallet address in creating and managing gift cards?

54. How is a blockchain ledger different from a traditional ledger?

55. Why doesn't blockchain need an intermediary organization to maintain the ledger?

56. Explain the concept of "immutability" in blockchain and why is it important for the security of transactions?

57. What characteristics of blockchain ledgers enhance transparency and security?

58. How does a consensus mechanism like Proof of Work (PoW) or Proof of Stake (PoS) work in confirming transactions on the blockchain?

59. Describe the process of recording and authenticating transactions in blockchain.

60. How does Blockchain use asymmetric encryption to protect transactions?

61. Why does not being able to change data in the blockchain help protect against fraud?

62. Explain the benefits that blockchain ledgers bring to financial and non-financial applications.

QUESTIONS AND EXERCISES CHAPTER 3

1. Who was created by Bitcoin, and what was its original goal?
2. How are Bitcoin transactions validated and added to the blockchain?
3. Article in Bitcoin transaction security?
4. How are Bitcoin addresses generated from public keys?
5. What is a Bitcoin wallet, and what types of wallets are there? Advantages and disadvantages of each type?
6. What is the role of nodes and miners in the Bitcoin network? What ensures that Bitcoin transactions are immutable and transparent?
7. What is the difference between public key and private key? Their role

8. How has Bitcoin changed the way we view money and financial transactions?
9. What are the main challenges facing Bitcoin? (e.g. power consumption, scalability)
10. How is Bitcoin different from traditional financial systems in terms of transparency, security, and decentralization?
11. In what context was Cardano born, and what problems of previous generation blockchains does it aim to solve?
12. What important milestones did Cardano's launch phase (2015-2017) achieve?
13. What stages is Cardano's development roadmap divided into, and what are the main goals of each stage?
14. What is Cardano's future vision, and how will it impact the blockchain ecosystem?
15. What layers is the architecture of the Cardano Blockchain divided into, and what is the role of each layer?
16. How does Cardano's Ouroboros consensus mechanism work to ensure security and decentralization?
17. How is the UTxO model different from the account-based model?
18. What are the main benefits of Cardano's EUTxO model, and why is it suitable for smart contracts?
19. What are the basic components of EUTxO, and what role do they play in trading?
20. How are keys in Cardano used to ensure transaction security and authentication?
21. How are payment addresses and staking addresses different, and what role do they play in the Cardano ecosystem?
22. How do smart contracts on Cardano work in the EUTxO model?
23. What are the main differences between smart contracts on Cardano and other blockchains?
24. What are the main roles in Cardano's On-Chain governance, and what responsibilities do each role have?
25. What is the decision-making process in Cardano's On-Chain governance?
26. What are the types of governance actions on Cardano, and what is the purpose of each?

QUESTIONS AND EXERCISES CHAPTER 4

1 What is the blockchain consensus algorithm, and what role does it play in maintaining the security and stability of the distributed system?

2 Outline the main steps in the working mechanism of a blockchain consensus algorithm.

3 Why is decentralization an important requirement for a consensus algorithm?

4 Describe the Byzantine generals problem and its relevance to Byzantine fault-tolerant systems (BFT).

5 Compare the advantages and disadvantages of Proof of Work (PoW) and Proof of Stake (PoS) algorithms.

6 Explain how the Proof of History (PoH) algorithm works in the Solana network and its role in increasing transaction processing speed.

7 How does the Proof of Authority (PoA) algorithm work, and why is it suitable for private blockchain networks?

8 Describe the Slot Leader selection mechanism in Cardano's Ouroboros algorithm.

9 How does the Proof of Capacity (PoC) algorithm help reduce energy consumption, and how is it different from PoW?

10 How does Delegated Proof of Stake (DPoS) solve the centralization problem compared to PoS?

11 Let's explain how the Byzantine fault tolerance (BFT) system ensures the stability of the blockchain network even when some nodes are dishonest.

12 One miner using the PoC algorithm has 5 TB of storage, while another has 10 TB. Calculate each person's relative probability of creating a new block.

13 Create a table comparing the advantages and disadvantages of PoW, PoS and PoC. Propose suitable application situations for each algorithm.

14 Simulate how to create and validate blocks using the PoW algorithm. Describes the steps from candidate block generation to block validation.

15 If you had to build a blockchain for a financial application with high requirements for speed and security, which algorithm would you choose among PoW, PoS, PoH or PoA? Explain why.

QUESTIONS AND EXERCISES CHAPTER 5

1. Analyze key blockchain scalability challenges and propose solutions.
2. Why is energy consumption such a big challenge for blockchain? What solutions are being developed to solve this problem?

3. Compare technical and administrative challenges in implementing blockchain.
4. Discuss the role of the legal framework in the development and application of blockchain technology.
5. Assess the impact of societal challenges on the widespread acceptance and adoption of blockchain technology.