

# FBLA Collegiate Foundations of Computer Science<sup>1</sup>

## Software Development Basics (15 test items)

1. Explain the steps of the software development life cycle (SDLC)
2. Discuss object-oriented and functional programming paradigms
3. Describe key features of object-oriented programming (e.g., encapsulation, abstraction, polymorphism, inheritance)
4. Discuss the use of comments in programs
5. Discuss the use of APIs and third-party libraries in programs
6. Discuss the importance of testing for software development
7. Discuss debugging methods
8. Interpret documentation for functions and classes

## Algorithmic Foundations (15 test items)

1. Describe basic data structures (e.g., arrays, lists, hashmaps)
2. Describe basic sorting algorithms (bubble sort, heap sort, merge sort, etc.)
3. Explain recursive algorithms and their use cases
4. Describe the speed and memory performance of simple algorithms
5. Describe basic search algorithms (e.g., linear, binary, two pointers)
6. Describe the advantages and disadvantages of hash tables
7. Write an algorithm in pseudocode to solve a problem

## Database Fundamentals (10 test items)

1. Create a relational database with tables, records, fields, primary keys, and foreign keys
2. Write basic SQL queries to obtain specific data sets
3. Design database tables to satisfy requirements

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\*Sources: These learning outcomes are based on content from the Computer Science Curricula 2023, Cybersecurity Curricula 2017, K-12 Computer Science Standards, and Ohio's Standards for Computer Science.

## Programming Fundamentals (15 test items)

1. Identify variables by name, data type, scope, and value
2. Call functions with multiple parameters
3. Discuss types of statements (assignment, function calls, control flow, etc.)
4. Describe characteristics of a class or object (attributes, constructors, methods, etc.)
5. Use I/O to create, read from, write to, and delete files
6. Predict the output of a block of code with specified inputs
7. Distinguish between pass-by-value and pass-by-reference
8. Evaluate expressions with function calls, variables, and Boolean logic

## Systems Foundations (15 test items)

1. Convert among common data representations (e.g., binary, hexadecimal, decimal)
2. Describe the basic architecture of a computer (e.g., CPU, ALU, buses)
3. Explain the functions of the operating system kernel
4. Discuss the memory hierarchy for computer storage (e.g., caches, registers, RAM)
5. Discuss the importance of locality in computer performance and organization
6. Describe the role of logic gates in computer systems (arithmetic, logic, ALU, etc.)

## Networking Foundations (10 test items)

1. Explain how data is transmitted between nodes (packets, packet switching, routers, switches, etc.)
2. Identify types of networks and their uses (WAN, LAN, Wi-Fi, etc.)
3. Discuss the functions of DNS, IP addresses, and MAC addresses
4. Describe the layers of the OSI model
5. Explain basic networking protocols (TCP/IP, UDP, DHCP, etc.)

### **Cybersecurity Foundations (10 test items)**

1. Discuss common cyber attacks and vulnerabilities (DoS, DDoS, phishing, SQL injection, malware, etc.)
2. Describe authentication methods (multi-factor authentication, digital certificates, SSO, etc.)
3. Describe confidentiality, integrity, and availability
4. Explain symmetric and asymmetric cryptography

### **Artificial Intelligence Foundations (10 test items)**

1. Describe foundational algorithms for artificial intelligence (e.g., minimax, search algorithms, alpha-beta pruning)
2. Explain machine learning paradigms (e.g., supervised, unsupervised, reinforcement learning)
3. Describe the concept of neural networks
4. Describe how problems are formulated for AI (initial state, action, transition, etc.)
5. Describe the characteristics of AI agents (autonomy, decision-making, perception, etc.)

## References

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