Introduction to Computer Science – Exam 2

Mission Brief: Welcome, Agent! You have been recruited by the Cyber Defense League to test your skills in a series of challenges. Your mission is to navigate through different levels of cybersecurity threats and secure the system. Earn points for correct answers, unlock achievements, and prove your prowess as a white hat hacker.

Achievements:

- **Quick Thinker:** Answer all Level 1 questions correctly within 5 minutes.
- **Data Guru:** Score at least 40 points in Level 2.
- **Algorithm Master:** Score at least 60 points in Level 3.

Hints:

- **Hint for Level 1:** Remember the basic principles of programming.
- **Hint for Level 2:** Think about the efficiency of accessing elements.
- **Hint for Level 3:** Consider the purpose and efficiency of algorithms.

Scoring:

- **Total Points:** 100
- **Achievements:** 30 points each

Good luck, Agent! The Cyber Defense League is counting on you to secure the system and protect our digital world.

Level 1: Key Concepts (10 points)

Scenario: You have infiltrated a suspicious network. To proceed, you need to bypass the initial security checks by answering these questions.

1. **Question:** What is the primary function of an algorithm?

- **A:** To store data
- **B:** To perform calculations
- **C:** To provide instructions for solving a problem
- **D:** To display information

2. **Question:** Which of the following is a valid variable name in Python?
    - **A:** 1variable
    - **B:** variable_1
    - **C:** variable-1
    - **D:** variable.1
3. **Question:** What does the acronym CPU stand for?
    - **A:** Central Processing Unit
    - **B:** Central Programming Unit
    - **C:** Computer Processing Unit
    - **D:** Central Performance Unit
4. **Question:** Which of the following is a high-level programming language?
    - **A:** Assembly
    - **B:** Machine Code
    - **C:** Python
    - **D:** Binary
5. **Question:** What is the main purpose of an operating system?
    - **A:** To manage hardware and software resources
    - **B:** To compile code
    - **C:** To connect to the internet
    - **D:** To store data

Level 2: Data Structures (20 points)

Scenario: You've successfully bypassed the initial security. Now, you need to navigate through the data storage systems to find the hidden vulnerabilities.

1. **Question:** What is the time complexity of accessing an element in an array?
    - **A:** O(n)
    - **B:** O(log n)
    - **C:** O(1)
    - **D:** O(n^2)
2. **Question:** Which data structure uses the Last In, First Out (LIFO) principle?
    - **A:** Queue
    - **B:** Stack
    - **C:** Linked List
    - **D:** Tree
3. **Question:** What is a linked list?
    - **A:** A collection of nodes where each node points to the next node
    - **B:** A collection of elements stored in contiguous memory locations
    - **C:** A hierarchical structure with a root node
    - **D:** A collection of key-value pairs
4. **Question:** Which of the following is a non-linear data structure?
    - **A:** Array
    - **B:** Linked List
    - **C:** Stack
    - **D:** Tree
5. **Question:** What is the primary advantage of using a hash table?
    - **A:** Fast insertion and retrieval
    - **B:** Easy to implement
    - **C:** Uses less memory

- **D:** Maintains order of elements

Level 3: Algorithms (30 points)

Scenario: You've reached the core of the system. To secure it, you must optimize the algorithms to prevent future breaches.

1. **Question:** What is the purpose of the binary search algorithm?
    - **A:** To sort an array
    - **B:** To search for an element in a sorted array
    - **C:** To merge two arrays
    - **D:** To find the maximum element in an array

    Analysis: Why are the incorrect responses incorrect?
2. **Question:** Which sorting algorithm has the best average-case time complexity?
    - **A:** Bubble Sort
    - **B:** Insertion Sort
    - **C:** Merge Sort
    - **D:** Selection Sort

    Rationale: Justify your response.
3. **Question:** What is the time complexity of the Quick Sort algorithm in the average case?
    - **A:** O(n)
    - **B:** O(n log n)
    - **C:** O(n^2)
    - **D:** O(log n)

    Analysis: Why is this the case and what would the case be in a worst-case scenario?
4. **Question:** Which algorithm is used to find the shortest path in a graph?
    - **A:** Depth-First Search

- **B:** Breadth-First Search
- **C:** Dijkstra's Algorithm
- **D:** Kruskal's Algorithm

Description: Provide an explanation of this algorithm and why it works for this scenario.

5. **Question:** What is the main advantage of the Merge Sort algorithm?
    - **A:** It is easy to implement
    - **B:** It has a stable time complexity of O(n log n)
    - **C:** It uses less memory
    - **D:** It is faster than Quick Sort

    Analysis: What are the biggest disadvantages of Merge Sort?