Programming Assessment 50 Questions Across 4 Problems

Experience Level Selection

Before starting, select your experience level:

- Complete Beginner (Need 50/100 - focus on Problems 1-2)
- Intermediate (Need 70/100 - should handle Problems 1-3)
- Advanced (Need 80/100 - expected to attempt all problems)
- Free to use your most comfortable programming language

Problem 1: Basic Variables and Operations (Easy - 12 Questions)

Multiple Choice Questions (6 questions)

Q1. What will be the output of this pseudocode?

```
SET x = 5
SET y = 3
PRINT x + y
```

a) 8 b) 53 c) 5 + 3 d) Error

Q2. Which of the following is a valid variable name in most programming languages? a) 2variable b) variable-name c) variable_name d) variable name

Q3. What data type is the value `"Hello World"` ?
a) Integer b) Float c) String d) Boolean

Q4. Which operator is used for exponentiation in most programming languages?

a) ^ b) ** c) exp d) pow

Q5. What is the result of `10 MOD 3` (modulus operation)?
a) 3 b) 1 c) 0 d) 3.33

Q6. What will this expression evaluate to: `NOT TRUE` ?
a) TRUE b) FALSE c) 1 d) 0

Tracing Questions (3 questions)

Q7. Trace through this pseudocode and determine the final value of `result`:

```
SET a = 10
SET b = 4
SET result = a - b * 2
PRINT result
```

What is printed?

Q8. What will be the output of this pseudocode?

```
SET x = 7
SET y = x + 3
SET x = y - 2
PRINT x, y
```

Q9. Trace this pseudocode step by step:

```
SET num = 15
SET num = num + 5
SET num = num DIV 4   // integer division
PRINT num
```

What is the final output?

Coding Questions (3 questions)

Q10. Write a function to calculate the area of a rectangle given length and width.
Requirements: Declare variables, get input, calculate area, display result

Q11. Write function to swap the values of two variables without using a third variable.
Show the step-by-step process

Q12. write a function that converts temperature from Celsius to Fahrenheit. *Formula: F = (C × 9/5) + 32*

Q13. Write a function for a program that calculates compound interest and determines how many years it takes for an investment to double. *Formula: A = P(1 + r/n)^(nt) Handle edge cases and provide year-by-year breakdown*

Q14. Write a Code that implements a basic calculator supporting parentheses and operator precedence. *Support: +, -, , /, (,) Use proper parsing and evaluation algorithms*

Q15. Write a Code for a function that converts any decimal number to any base (2-16). *Handle negative numbers and fractional parts Include proper digit mapping for bases > 10*

Problem 2: Control Structures (Medium - 15 Questions)

Multiple Choice Questions (6 questions)

Q13. What will this pseudocode do?

```
SET x = 10
IF x > 5 THEN
    PRINT "Greater"
ELSE
    PRINT "Lesser"
END IF
```

a) Print "Greater" b) Print "Lesser" c) Print both d) Error

Q14. Which loop structure is best for iterating a known number of times? a) WHILE loop b) FOR loop c) DO-WHILE loop d) Infinite loop

Q15. What will this pseudocode output?

```
FOR i = 0 TO 2
    PRINT i
END FOR
```

a) 1 2 3 b) 0 1 2 c) 0 1 2 3 d) 1 2 3 4

Q16. What will happen with this pseudocode?

```
SET x = 0
WHILE x < 3
    PRINT x
    SET x = x + 1
END WHILE
```

a) Prints 0, 1, 2 b) Prints 1, 2, 3 c) Infinite loop d) Error

Q17. What is the purpose of the `BREAK` statement? a) Skip to next iteration b) Exit the loop entirely c) Pause the program d) Create a new loop

Q18. What does `CONTINUE` do in a loop?
a) Exits the loop b) Skips remaining code in current iteration c) Restarts the loop d) Pauses execution

Tracing Questions (4 questions)

Q19. Trace this pseudocode:

```
SET total = 0
FOR i = 1 TO 3
    SET total = total + i * 2
END FOR
PRINT total
```

What is the final value of `total`?

Q20. What will this pseudocode print?

```
SET x = 10
WHILE x > 0
    IF x MOD 2 = 0 THEN
        PRINT "Even:", x
    END IF
```

```
        SET x = x - 3
    END WHILE
```

Q21. Trace through this nested loop:

```
SET result = ""
FOR i = 1 TO 2
    FOR j = 1 TO i
        SET result = result + STRING(i)
    END FOR
END FOR
PRINT result
```

What is the final value of `result`?

Q22. What does this pseudocode output?

```
SET count = 0
FOR i = 0 TO 4
    IF i MOD 2 = 1 THEN
        SET count = count + 1
    END IF
END FOR
PRINT count
```

Coding Questions (5 questions)

Q23. Write pseudocode to find the largest number among three given numbers. *Use IF-ELSE statements, no arrays*

Q24. Write a Code for a simple guessing game where the user has 3 attempts to guess a number between 1-10. *Include input validation and feedback*

Q25. Write a Code to calculate the factorial of a positive integer using a loop. *Example: 5! = 5 × 4 × 3 × 2 × 1 = 120*

Q26. Write a Code that prints all even numbers from 2 to 20. *Use appropriate loop structure*

Q27. Write pseudocode to validate a password with these rules:

- At least 8 characters long
- Contains at least one digit
- Contains at least one uppercase letter *Return TRUE if valid, FALSE otherwise*

Problem 3: Functions and Data Structures (Medium-Hard - 15 Questions)

Multiple Choice Questions (6 questions)

Q28. What will this function return?

```
FUNCTION addNumbers(a, b)
    RETURN a + b
END FUNCTION


SET result = addNumbers(3, 7)
```

a) 10 b) 37 c) "3 + 7" d) Nothing

Q29. What is the scope of variable `x` in this pseudocode?

```
FUNCTION calculate()
    SET x = 5
    RETURN x * 2
END FUNCTION
```

a) Global scope b) Local to the function c) Both global and local d) Undefined

Q30. What will this pseudocode output?

```
FUNCTION greet(name = "World")
    RETURN "Hello, " + name + "!"
END FUNCTION


PRINT greet()
```

a) Hello, World! b) Hello, name! c) Hello, ! d) Error

Q31. What is the length of this array?

```
SET myArray = [1, 2, [3, 4], 5]
```

a) 3 b) 4 c) 5 d) 6

Q32. What will `myArray[1]` return from `SET myArray = ["a", "b", "c", "d"]`? a) "a"
b) "b" c) "c" d) Error

Q33. In a hash table/dictionary, what is the average time complexity for lookup
operations? a) O(1) b) O(log n) c) O(n) d) O(n²)

Tracing Questions (4 questions)

Q34. Trace this function:

```
FUNCTION processList(numbers[])
    SET total = 0
    FOR each num IN numbers
        IF num MOD 2 = 0 THEN
            SET total = total + num
        END IF
    END FOR
    RETURN total
END FUNCTION

SET result = processList([1, 2, 3, 4, 5, 6])
PRINT result
```

What is printed?

Q35. What will this pseudocode output?

```
FUNCTION modifyArray(arr[])
    ADD 4 TO arr
    RETURN arr
END FUNCTION
```

```
SET original = [1, 2, 3]
SET newArray = modifyArray(original)
PRINT LENGTH(original), LENGTH(newArray)
```

Q36. Trace through this hash table manipulation:

```
SET scores = {"Alice": 85, "Bob": 92}
SET scores["Charlie"] = 78
SET scores["Alice"] = scores["Alice"] + 5
PRINT scores["Alice"], SIZE(scores)
```

Q37. What does this nested function return?

```
FUNCTION outer(x)
    FUNCTION inner(y)
        RETURN x + y
    END FUNCTION
    RETURN inner(x * 2)
END FUNCTION

SET result = outer(3)
PRINT result
```

Coding Questions (5 questions)

Q38. Write a function in pseudocode that takes an array of integers and returns the sum of all positive numbers. *Handle edge cases like empty arrays*

Q39. Create pseudocode for a function that reverses a string without using built-in reverse functions. *Example: "hello" becomes "olleh"*

Q40. Write pseudocode for a function that finds the second largest number in an array. *Handle cases where array has duplicates or insufficient elements*

Q41. Create a function that checks if a string is a palindrome (reads same forwards and backwards). *Ignore case and spaces. Example: "A man a plan a canal Panama"*

Q42. Write pseudocode for a simple stack implementation with push, pop, and isEmpty operations. *Use an array as the underlying data structure*

Problem 4: Advanced Concepts (Hard - 8 Questions)

Multiple Choice Questions (3 questions)

Q43. What is the time complexity of binary search in a sorted array? a) O(1) b) O(log n) c) O(n) d) O(n²)

Q44. What will this recursive function return for `factorial(4)`?

```
FUNCTION factorial(n)
    IF n <= 1 THEN
        RETURN 1
    END IF
    RETURN n * factorial(n - 1)
END FUNCTION
```

a) 24 b) 12 c) 4 d) 10

Q45. In object-oriented programming, what is inheritance? a) Creating multiple objects b) One class acquiring properties of another class c) Hiding implementation details d) Grouping related functions

Tracing Questions (2 questions)

Q46. Trace this recursive function:

```
FUNCTION fibonacci(n)
    IF n <= 1 THEN
        RETURN n
    END IF
    RETURN fibonacci(n-1) + fibonacci(n-2)
END FUNCTION

SET result = fibonacci(5)
PRINT result
```

What is the output?

Q47. Trace this sorting algorithm:

```
FUNCTION bubbleSort(arr[], n)
    FOR i = 0 TO n-2
        FOR j = 0 TO n-2-i
            IF arr[j] > arr[j+1] THEN
                SWAP arr[j] AND arr[j+1]
            END IF
        END FOR
    END FOR
END FUNCTION

SET numbers = [64, 34, 25]
CALL bubbleSort(numbers, 3)
PRINT numbers
```

Coding Questions (3 questions)

Q48. Write a recursive function that calculates the sum of all numbers from 1 to n.
Include base case and recursive case

Q49. Create pseudocode for a binary search algorithm that finds a target value in a sorted array. *Return the index if found, -1 if not found*

Q50. Design pseudocode for a simple class "BankAccount" with the following:

- Properties: accountNumber, balance, ownerName
- Methods: deposit(amount), withdraw(amount), getBalance()
- Include proper encapsulation and validation

Q51. Write a function that implements the Merge Sort algorithm. *Include the merge helper function and handle the divide-and-conquer approach*
Requirements: Split array recursively, merge sorted subarrays

Q52. Create a Graph representation using adjacency lists and implement a Depth-First Search (DFS) traversal. *Include: addVertex, addEdge, and DFS functions Handle visited tracking and recursive exploration*

Q53. Design a Hash Table implementation with collision handling using chaining. *Include: hash function, insert, search, delete operations Handle dynamic resizing when load factor exceeds 0.75*

Q54. Write a function for finding the Longest Common Subsequence (LCS) between two strings using dynamic programming. *Example: LCS("ABCDGH", "AEDFHR") = "ADH" Create the DP table and reconstruct the solution*

Q55. Create a function for a Red-Black Tree insertion algorithm. *Include: node structure, insertion, rotation operations, and rebalancing Handle all cases for maintaining Red-Black tree properties*

Q56. write a code for implementing Dijkstra's shortest path algorithm. *Use a priority queue/min-heap for efficient vertex selection Handle edge weights and return shortest distances from source to all vertices*

Q57. Write a function that solves the N-Queens problem using backtracking. *Place N queens on an N×N chessboard so no two queens attack each other Include constraint checking and backtracking logic*

Q58. Write a Code for a Trie (Prefix Tree) data structure with insert, search, and prefix matching operations. *Include: node structure, word insertion, complete word search, and finding all words with given prefix Handle end-of-word marking and memory-efficient implementation*

Scoring Guidelines

Complete Beginners (Need 25/50 correct = 50%)

- Focus on Problems 1-2
- Should demonstrate understanding of basic programming concepts
- Coding questions can be partially correct for credit

Intermediate (Need 35/50 correct = 70%)

- Should handle Problems 1-3 confidently
- Expected to write functional pseudocode
- Should understand control structures and basic algorithms

Advanced (Need 40/50 correct = 80%)

- Expected to perform well across all problems
- Should demonstrate understanding of advanced concepts
- Coding solutions should be efficient and well-structured

Evaluation Criteria for Coding Questions:

- **Correctness**: Does the pseudocode solve the problem?
- **Logic**: Is the algorithmic thinking sound?
- **Structure**: Proper use of control structures and functions
- **Edge Cases**: Consideration of special cases
- **Clarity**: Readable and well-organized pseudocode