



PAC INSTITUTE OF TECHNOLOGY AND SOCIAL STUDIES JANUARY-APRIL 2025 ASSESSMENT

FORMATIVE ASSESSMENT

Qualification / Course : COMPUTER SCIENCE LEVEL 6

Unit of Competency : UNDERSTAND ALGORITHMS AND DATA STRUCTURES

WRITTEN ASSESSMENT

TIME: 3 HOURS

INSTRUCTIONS TO THE CANDIDATE:

- 1. Read all the instructions carefully before attempting the questions.*
- 2. This paper consists of two sections, A & B.*
- 3. You are allowed 3 Hours to Answer the questions.*
- 4. Marks for each question are indicated in brackets.*
- 5. Write your responses in the Separate Answer booklet provided.*
- 6. Do not write anything on this question paper.*

SECTION A: (40 Marks)

(Answer all the questions in this section)

1. Define the following terms. (4 Marks)
 - a) Data structure
 - b) Algorithm analysis
 - c) Arrays
 - d) Stacks
2. Outline **FOUR** specific characteristics of algorithms that you would prioritize when creating an algorithm. (4 Marks)
3. Algorithm X and Algorithm Y are two sorting algorithms. Algorithm X has a time complexity of $O(n^2)$, while Algorithm Y has a time complexity of $O(n \log n)$. Which algorithm would you choose for sorting a large dataset? Justify your answer. (4 Marks)
4. Using a suitable example, state the difference between *static* and *dynamic* data structures. (4 Marks)
5. Basic operations form the foundation of stack functionality; Identify **THREE** basic operations within the stack. (3 Marks)
6. Write an algorithm that is used to implement enqueue operations as used in queue data structure. (4 Marks)
7. Searching algorithms are used for the purpose of determining the existence and/or position of a target element within a provided data structure. Explain the following terms:
 - a. Hashing technique. (2 Marks)
 - b. Linear search (2 Marks)
 - c. Binary Search (2 Marks)
8. Write an algorithm for a simple program that will display the largest of the three numbers. (4 Marks)
- 9.9. Outline **THREE** factors that June should consider when selecting appropriate data structure. (3 Marks)
10. 10. Use a binary search tree to sort the following data in ascending order: **8, 9, 7, 12, 5, 4, 6, 10, 13, 2.**

SECTION B (60 Marks)*(Answer any THREE questions in this section)*

11.

- a. In today's world, applications are getting more complex and data rich, this has brought various challenges. Discuss **THREE** such challenges faced along with how data structures can help solve them. (9 Marks)
- b. Write a C# program that will create a stack of integers named *myStack*, add integer 42 to the top of the stack and display its contents. (11 Marks)

12.

- a. Explain **FIVE** operations that can be performed in stack data structure. (10 Marks)
- b. Given coin denominations [1, 2, 5, 10, 20, 50, 100, 200] and a target amount of 63 cents, find the minimum number of coins needed to make up that amount using greedy algorithm approach. (10 Marks)

13.

- a. Discuss **FIVE** characteristics of an algorithm. (15 marks)
- b. The array below has seven elements. Illustrate searching 34 using the linear search technique. (5 marks)

0	1	2	3	4	5	6	← Array index
19	24	48	73	34	21	14	← Array Elements

14.

- a. Linked lists overcome the challenges of using array data structures. Thus, their wide range of applications. Explain SIX applications of linked lists data structures. (12 marks)
- b. Briefly discuss FOUR basic operations performed in linked list. (8 marks)