

061306T4CPM

COMPUTER PROGRAMMING LEVEL 6

IT/OS/CP/CR/05/6/A

DESIGN ALGORITHMS AND DATA STRUCTURES

NOV/DEC 2023



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION  
COUNCIL (TVET CDACC)**

**WRITTEN ASSESSMENT**

**TIME: 3 Hours**

**INSTRUCTIONS TO CANDIDATE**

1. The paper consists of **two** sections: **A** and **B**
2. Answer **ALL** questions in Section **A** and any **Three** from section **B**
3. Marks for each question are indicated in the brackets
4. A separate answer booklet will be provided
5. Do not write on the question paper

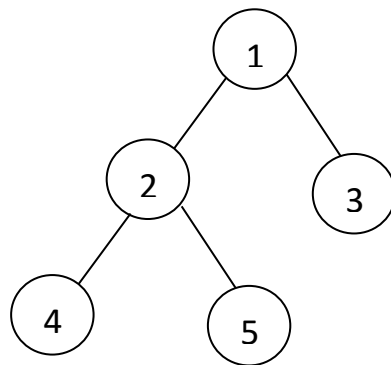
***Candidates should answer the questions in English***

***This paper consists of 3 printed pages***

***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***

**SECTION A: (40 Marks)***(Answer ALL the questions in this section)*

1. Define the following terms. (4 Marks)
  - i) Data structure
  - ii) Recursive function
2. Differentiate between file structure and storage structure. (4 Marks)
3. List THREE main categories of data structures (3 Marks)
4. State TWO reasons why arrays are a fundamental and widely used data structure in computer programming. (2 Marks)
5. Explain a situation where storing items in an array is clearly better than storing items on a linked list. (2 Marks)
6. Deduce the pre-order and post-order sequences for the following binary tree. (4 Marks)



7. Differentiate between homogeneous and heterogeneous data structures giving an example in each case. (4 Marks)
8. Explain the meaning of a balanced tree. (2 Marks)
9. Explain the following C# code (2 Marks)
 

```
int [] numbers = new int [5];
```
10. Explain the following operations in relation to queue data structures. (4 Marks)
  - i) Enqueue
  - ii) Dequeue
11. List TWO examples of divide and conquer algorithms. (2 Marks)
12. State any FOUR considerations that may influence the choice of an internal sorting algorithm. (4 Marks)
13. List THREE application areas of data structures. (3 Marks)

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

- 14.
- 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)
  - 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)
- 15.
- Explain FIVE operations that can be performed in stack data structure. (10 Marks)
  - 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)
- 16.
- Discuss FIVE characteristics of an algorithm. (15 marks)
  - 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 |
- 17.
- 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)
  - Briefly discuss FOUR basic operations performed in linked list. (8 marks)

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