## ALGORITHMS AND DATA STRUCTURES

**UNIT CODE:**ICT/CU/CS/CR/09/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Understand Algorithms and Data Structures

**Duration of Unit:** 140 hours

**Unit Description**

This unit covers the competencies required to understand algorithms and data structure. It involves Understand fundamental principles of algorithms understanding fundamental concepts of data structures, linked lists, stacks and queues, search techniques and sorting techniques

**Summary of Learning Outcomes**

1. Understand fundamental principles of algorithms
2. Understand fundamental concepts of data structures
3. Understand linked lists
4. Understand stacks and queues
5. Understand search techniques
6. Understand sorting techniques

**Learning Outcomes, Content and Suggested Assessment Methods**

| Learning Outcome | Content | Suggested Assessment Method |
|---|---|---|
| 1. Understand Fundamental principles of algorithms | • Definition of an Algorithm<br>• Characteristics of an Algorithm<br>• Principles of algorithm writing<br>• Algorithm Analysis<br>• Complexities of algorithms<br>✓ Space<br>✓ Time<br>• Greedy algorithms are outlined<br>✓ Counting coins<br>• Divide and conquer algorithms<br>✓ Divide /break<br>✓ Conquer/solve<br>✓ Merge/combine | • Written tests<br>• Oral tests<br>• Practical tests |

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|---|---|---|
| 2. Understand fundamental concepts of data structures | • Key concepts in data structures<br>✓ Data<br>✓ Object<br>✓ Data type<br>• Explanation of Arrays<br>• Array insertion operations<br>✓ At the beginning<br>✓ At the given index<br>✓ After the given index<br>✓ Before the given index<br>• Array delete, search and update<br>• Demonstration of array operations | • Written tests<br>• Oral tests<br>• Practical tests |
| 3. Understand Linked lists | • Linked lists<br>✓ Linked lists representation<br>✓ Types of linked lists<br>• Doubly linked lists<br>✓ Representation<br>✓ Basic operations<br>• Circular linked lists<br>✓ Representation<br>✓ Basic operations<br>• Demonstration of basic operations for the various linked lists using Java<br>✓ Insertion<br>✓ Deletion<br>✓ Reverse<br>✓ Display | • Written tests<br>• Oral tests<br>• Practical tests |
| 4. Understand Stacks and Queues | • Definition of Stacks<br>• Representation of stacks<br>• Basic operations<br>✓ Pop<br>✓ Push<br>• Definition of queues<br>• Representation of queues<br>• Basic operations<br>✓ Enqueue<br>✓ Dequeue | • Written tests<br>• Oral tests<br>• Practical tests |

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|---|---|---|
| | • Demonstration of stack and queues using Java | |
| 5. Understand Search Techniques | • Definition of search<br>• Explanation of Linear Search<br>• Explanation of Binary Search<br>• Demonstration of linear search and binary search using Java | • Written tests<br>• Oral tests<br>• Practical tests |
| 6. Understand Sorting Techniques | • Definition of Sorting<br>• Categories of sorting<br>✓ Stable and not stable sorting<br>✓ Adaptive and Non-Adaptive Sorting Algorithm<br>✓ In place and not in place<br>• Types of Sorting algorithms<br>✓ Bubble sort<br>✓ Insertion sort<br>✓ Selection sort<br>• Demonstration of sorting algorithms using Java | • Written tests<br>• Oral tests<br>• Practical tests |



**Suggested Methods of Instruction**

- Presentations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised practical assignments
- Visiting expert from the ICT sector;
- Industrial visits

**Recommended Resources**

**Tools**

- JDK

**Equipment**

- Computers

**Materials and supplies**

- Instructional materials
- Stationery

**Reference materials**

- Trainer recommended resources including web resources