



**ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO
STATE
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING**

FIRST SEMESTER EXAMINATION, 2017/2018 ACADEMIC SESSION

COURSE TITLE: DATA STRUCTURE AND ALGORITHMS (2UNITS)

COURSE CODE: ECT 535

EXAMINATION DATE: MARCH 2018

COURSE LECTURER: DR. B.I. AKHIGBE

A rectangular box containing a handwritten signature in black ink, which appears to be 'B.I. Akhigbe'.

HOD's SIGNATURE

TIME ALLOWED: 2 HOURS

INSTRUCTIONS:

1. ANSWER **FOUR QUESTIONS ONLY** WITH QUESTION 1 COMPULSORY
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION

Question #1: [COMPULSORY]

- a. List and explain the steps that are involved in writing a computer program to solve a given problem. [6 marks]
- b. Design an algorithm, which takes 2 arrays and returns *true* if the arrays are disjoint. State the complexity of such algorithm. *Hint: (i) disjoint - arrays have no elements in common, and (ii) For pseudocode – use English or a mixture of English & notation with no programming language dependence.* [4 marks]
- c. What are the common Big O asymptotic notations, and why is Big O the most commonly used notation for Asymptotic Analysis? State the implication of the following Big O notations in terms of the time complexities on the algorithm that runs on them - (i) $\log(n)$ (ii) $n \cdot \log(n)$ [5 marks]
- d. Given the array below, with a function $f(i) = x$;
 Index (i) = 0 1 2 3 4 5 6 7 8
 Array space (x) =

9	18		12	3	14	4	21	
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 (i) State the best two orders in which the elements could have been added to the array, and
 (ii) if $f(5)$ is initiated for deletion from the array, write how the resultant array will look like. [4 marks]
- e. Write short notes on the following: [2 marks each]
 i. Big θ
 ii. Big O
 iii. Big Ω
- f. With the aid of appropriate diagrams explain how the insertion of a node into a Doubly Linked List *Hint: five diagrams are required* [5 marks]

Question #2:

- a. List the 8 basic operations that are supported by a Doubly Linked List and explain any four of them. [8 marks]
- b. Discuss the two main categories of analysis of the efficiency of an algorithm. [3.5 marks]
- c. Discuss the following concepts: (i) Built-in Data Type, and (ii) Derived Data Type. [3.5 marks]

Question #3:

- a. The diagrams in Figure 1 are instances of the Nodes of a Singly Linked List Data Structure. The instances are a product of a set of Class definition. State the Class definition as clearly as possible. State the three problems with modern application aside being complex and data rich. [5 marks]

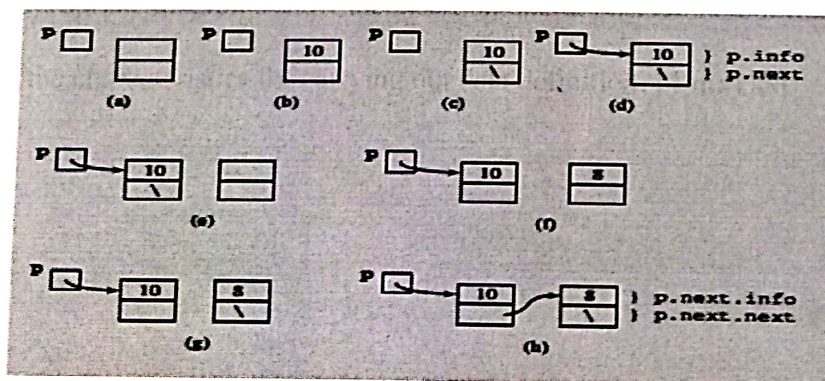


Figure 1: Singly Linked List Data structure

- b. Imagine that you want to insert a New node say B in between Node A and C of a list. It is assumed that Node A and Node C exist. To achieve the foregoing and arrive at an entirely new singly linked list with Node A, New Node B, and Node C the following pseudocode are provided.
 $NewNode.next \rightarrow RightNode;$ and
 $LeftNode.next \rightarrow NewNode.$
 With the aid of appropriate diagrams show the insertion operations. *Hint: four diagrams are required.* [6 marks]
- c. State and explain the characteristics for carrying out data definition. [4 marks]

Question #4:

- a. List the basic (i) types of linked lists, and (ii) operation of linked lists. State the examples of Contiguous. [6.5 marks]
- b. What is Computational Complexity? Highlight the usefulness of Asymptotic Analysis. [4.5 marks]
- c. Going by the same conception in Question 4b above but this time for a deletion operation; the given pseudocode below will allow the removal of a target node in between two nodes.

LeftNode.next -> TargetNode.next;

TargetNode.next -> NULL;

With the aid of appropriate diagrams show the insertion operations. *Hint:* four diagrams are required.

[4 marks]

Question #5:

- a. Discuss fully the Concept of the Queue as a data structure. [4 marks]
- b. State and explain the basic operations that is supported by a List data structure. List examples of Derived data type. [8 marks]
- c. Explain the concept of extensionality as a property of the List, state the features that is commonly used to establish the trade-off between the Linked List and Array data structures. [3 marks]

Question #6:

- a. An array is a very useful data structure for good programming using any languages, but it has some limitations. Why, and which of the data structure can be used to overcome the limitation? [4.5 marks]
- b. Explain the different scenarios for a sorting operation. Write short note on the following concepts.
(i) Contiguous data structure (ii) Array data structure [6.5 marks]
- c. With the aid of appropriate diagrams explain how the removal of a node from a Doubly Linked List is done. *Hint:* four diagrams are required [4 marks]