



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF COMPUTING AND INFORMATICS
DEPARTMENT OF COMPUTER SCIENCE**

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE, BACHELOR OF INFORMATICS	
QUALIFICATION CODE: 07BCMS, 07BAIT	LEVEL: 5
COURSE: DATA STRUCTURES AND ALGORITHMS 1	COURSE CODE: DSA521S
DATE: NOVEMBER 2022	PAPER: THEORY
DURATION: 2 HOURS	MARKS: 80

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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INSTRUCTIONS
<ol style="list-style-type: none">1. Answer ALL the questions.2. Read all the questions carefully before answering.3. Number the answers clearly

THIS QUESTION PAPER CONSISTS OF 4 PAGES
(Excluding this front page)

PERMISSIBLE MATERIALS

1. NON-PROGRAMMABLE CALCULATOR

QUESTION 1: Multiple Choice Questions [10 Marks]

- Answer all the questions in the provided booklet.
- The question consists of 10 questions.

1.1. Which of the following operations can be performed on singly-linked list, doubly-linked list and circular linked list?

- A. Insertion - adding an element to the list.
- B. Deletion - removing an element from the list.
- C. Search - seek for an element in a given list.
- D. All of the above.

1.2. When trying to delete data from a stack, but the stack is empty; this condition is usually called...

- A. Underflow
- B. Overflow
- C. Full Capacity
- D. Error

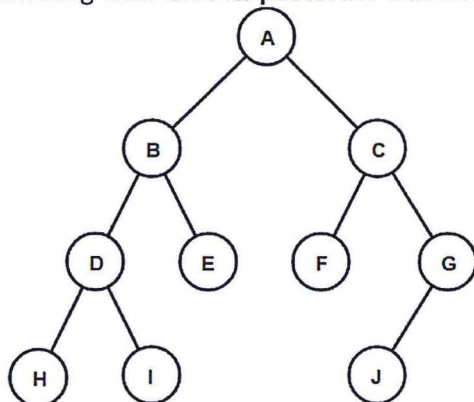
1.3. A sorting algorithm that uses a divide and conquer approach to sorting lists is

- A. Insertion Sort
- B. Bubble Sort
- C. Quick Sort
- D. Selection Sort

1.4. Which of the following would you use to get the value in the first row and second column of a 2D array/matrix called twoDimenArray?

- A. twoDimenArray[2][3]
- B. twoDimenArray[0][1]
- C. twoDimenArray[1][2]
- D. twoDimenArray[3][2]

1.5. Given the following tree. Give its **postorder traversal** algorithm output.



- A. ABDHIECGFJ
- B. HDIBEAFCJG
- C. HIDEBFJGCA
- D. HDIBEGFCJA

1.6. What are the applications of Stack?

- A. Queues in routers/switches

- B. Check parenthesis matching in an expression
- C. Process scheduling
- D. Shared resource

1.7. Which one of the following is a non-linear data structure?

- A. Queue
- B. Stack
- C. Graph
- D. All the above

1.8. Two vertices in a graph are said to be adjacent vertices (or neighbours) if there is a path of length ____ connecting them.

- A. At least 1
- B. At least 2
- C. At least less than 2
- D. 1

1.9. If the node to be deleted has _____, we delete the node and attach the left subtree to the deleted node's parent.

- A. Only a left subtree
- B. Only a right subtree
- C. No children
- D. Has no children

1.10. Which one of the following is a searching algorithm?

- A. Merge Search
- B. Sequential search
- C. Quick Search
- D. Selection search

QUESTION 2: Structured Questions [70 Marks]

- Answer all the questions in the provided booklet.
- The Question consists of 5 questions.

- 2.1 Consider the following data elements: DSA, INP, BST, BCMS, DPG, PRG
By way of a diagram show how the above data can be stored in an array, conceptually. Your diagram must clearly show the cells as well as the cell index. [12 Marks]
- 2.2 Consider the following data elements: 23, 12, 10, 56, 8, by way of a diagram show how the above data can be stored using a singly-linked list. [12 Marks]
- 2.3 Study the code fragment below and answers the following questions.

```
mystery (marks[], size)
  FOR (outerCounter=0 to size-1)
    lowestIndiex= outerCounter

    FOR (innerCounter= outerCounter +1 to size-1)
      IF(marks[innerCounter] < marks[lowestIndiex] )THEN
        lowestIndiex= innerCounter

      ENDIF
    ENDFOR
    marks[outerCounter]= marks[lowestIndiex]
  ENDFOR
ENDmystery()
```

- a) What is the final output of the algorithm if an array, **marks= {45, 75, 62, 18}** is passed to function **mystery()**? [8 marks]
- b) If the two (2) highlighted lines are added, what will be the output for the same array, **marks={45,75, 62,18}**. Show state or content of array after each iteration of the outer loop. [6 Marks]

```
mystery (marks[], size)
  FOR (outerCounter=0 to size-1)
    lowestIndiex= outerCounter

    FOR (innerCounter= outerCounter +1 to size-1)
      IF(marks[innerCounter] < marks[lowestIndiex] )THEN
        lowestIndiex= innerCounter

      ENDIF
    ENDFOR
    temp= marks[outerCounter]
    marks[outerCounter]= marks[lowestIndiex]
    marks[lowestIndiex]= temp
```



```
ENDFOR
ENDmystery()
```

45, 75, 62, 18 (original list)
AFTER 1st iteration of outer loop

AFTER 2nd iteration of outer loop

AFTER 3rd iteration of outer loop

c) What is the general task performed by the function mystery () in (b) above? [2 marks]

2.4 Given the following output of a **postorder** traversal of a binary tree;

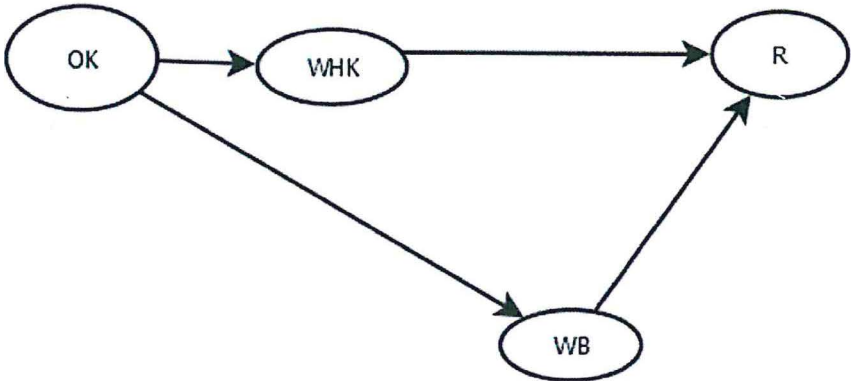
Output: 21, 40,65,41,30

a) Recreate the binary tree for the postorder traversal output provided above. [10 marks]

b) What is the output of a preorder traversal of the tree you created in 2.4(a) above? [4 marks]
Output:

c) What is the output of an inorder traversal of the tree you created in 2.4(a) above? [4 marks]
Output:

2.5 Study the below and answer the questions that follows.



a) One of the ways to represent a graph data structure is an adjacency matrix. Draw the adjacency matrix for this graph. [10 Marks]

b) What is the in-degree of the node **WB**? [2 Marks]

***** End of the Paper *****

