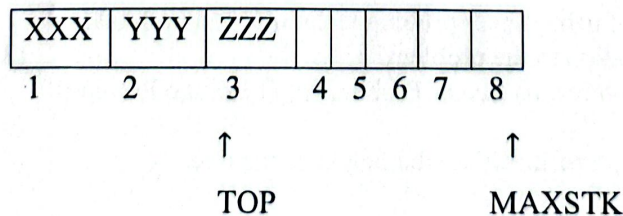


**BOWEN UNIVERSITY, IWO**  
**SCHOOL OF COMPUTING AND COMMUNICATIONS**  
**COMPUTER SCIENCE PROGRAMME**  
**B.Sc. DEGREE FIRST SEMESTER EXAMINATION, 2023/2024 SESSION**  
**COURSE TITLE: DATA STRUCTURE AND ALGORITHM**  
**COURSE CODE: SEN 209 COURSE CREDIT: 3 DURATION: 2 hours**  
**INSRUCTION: ANSWER ANY FOUR QUESTIONS**

- 1(a) Carefully compare a linked list and an array as two important components of data structure. **(6 marks)**
- (b) A medical consultant keeps the names of his patients and their bed numbers as follows:

Bed No	1	2	3	4	5	6	7	8	9	10	11	12
Name	Kike	-	Dare	Maxwell	Adam	-	Lane	Green	Samuel	-	Field	Nelson

- Produce a linear linked list that produces the names in alphabetical order **(8 marks)**
- (c) Write an algorithm that traverse a linked list and apply an operation PROCESS on each of the elements **(6 marks)**
- (d) With the aid of diagram, explain the two major types of linked list you are familiar with **(5 marks)**
- 2(a) What is a “Stack list” (illustration is required) **(5 Marks)**
- (b) Write an algorithm to:
- (i) PUSH an element into stack list **(5 marks)**
- (ii) POP an element from a stack list **(5 marks)**



- (c) Use the algorithm in (i) and (ii) to simulate operation PUSH (STACK, WWW) in the diagram above **(10 marks)**

3a. Evaluate the expressions:

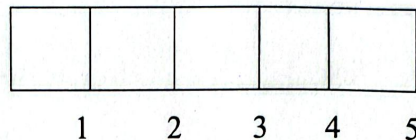
(i) P: 5, 6, 2, +, x, 12, 4 (5 marks)

(ii) P: 12, 7, 3 -, 1, 2, 1, 5, +, x, + (5 marks)

(b) What is priority queue? (5 marks)

### QUEUE

(a)



Consider an empty queue data structure indicated above. Determine the value of FRONT and REAR when:

- (a) The list is empty
- (b) A, B and C are inserted
- (c) A is deleted
- (d) D and then E are Inserted
- (e) B and C are deleted
- (f) F is inserted
- (g) D is deleted (10 marks)

### Question Four

- a. Explain the complexity of linear search algorithm (All mathematical notations should be clearly stated.) (5 marks)
- b. Describe a bubble sort algorithm that can be used to sort elements in a given list. (6 marks)
- c. Consider a linear search function  $h(x) = x$  in a hash table. State two major disadvantages of using this function. (2 marks)
- d. What is the major problem of using linear probing technique in a hash table and what is the possible solution to the problem? (2 marks)
- e. State a mathematical function for: (i) Linear Probing (ii) Quadratic Probing techniques in a hash table. (6 marks)
- f. There are 7 nodes in a binary tree, calculate the height of the tree. (4 marks)

### Question Five

- a. DATA is a sorted list. If the first element of the list appears at position BEG and the last element of the list appear at position END. Write a binary search algorithm to locate a particular

element in the list.

**(10 marks)**

- b. Discuss the complexity of your algorithm 5a above **(5 marks)**
- c. Assume the list is given as DATA: 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 89, explain how the algorithm can be used to search and locate element "40" **(6 marks)**
- d. If there are 1,000,000 elements in DATA, how many times will the list be sub- divided before you can locate the particular element in the list? **(4 marks)**

#### **Question Six**

- a. Based on your practical exposure in this course, enumerate the general steps that can be used to remove item from a binary search tree (code not required) **(5 marks)**
- b. Given a list of elements: 44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66. Use 44 as your point of reference, explain the various steps involved in creating the first sub-list using quicksort algorithm. **(10 marks)**
- c. A is an array with N-element, write a quick sort algorithm to sort elements in A **(10 marks)**