

GRETSA UNIVERSITY - THIKA

**UNIVERSITY EXAMINATIONS
MAY - AUGUST 2018 SEMESTER**

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: BSCS 201

COURSE TITLE: ALGORITHMS AND DATA STRUCTURES

DATE: 8TH AUGUST 2018

TIME: 8.00 AM – 11.00 AM

INSTRUCTIONS TO CANDIDATES

1. SECTION A IS **COMPULSORY**.
2. SECTION B: ANSWER ANY OTHER **THREE** QUESTIONS.
3. **DO NOT** WRITE ANYTHING ON THIS QUESTION PAPER AS IT WILL BE AN EXAM IRREGULARITY.
4. ALL ROUGH WORK SHOULD BE AT THE BACK OF YOUR ANSWER BOOKLET AND CROSSED OUT.

CAUTION: *All exam rooms are under CCTV surveillance during the examination period.*

SECTION A: COMPULSORY

Question One

- a) With relevant examples, differentiate between the following types of trees
- i. Full binary tree [2 marks]
 - ii. Complete binary tree [2 marks]
 - iii. Binary search tree [2 marks]
- b) Differentiate between space complexity and time complexity of an algorithm [4 marks]
- c) Given the below array, perform the following operations

10	23	11	34	89	45	56	8
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- i. Sort the array using insertion sort algorithm [5 marks]
 - ii. Write an algorithm illustrating insertion of an array element 25 at index 4 of the array [6 marks]
 - iii. Outline any five challenges of using arrays in programming [5 marks]
- d) State and explain any five characteristics of algorithms [5 marks]
- e) Write an algorithm that allows one to search for a node in a binary search tree [6 marks]
- f) Explain the three cases used to compare a data structure's execution time [3 marks]

SECTION B: ANSWER ANY THREE QUESTIONS

Question Two

- a) Differentiate between
- i. Built in data types and derived data types [4 marks]
 - ii. Stack underflow and stack overflow errors [4 marks]
- b) State and explain any three computer science applications of queues [6 marks]
- c) Explain any three differences between queues and stacks data structures [6 marks]

Question Three

- a) Using a relevant example, explain the concept of divide and conquer in solving computing problems [5 marks]
- b) State and explain any three implementation issues of divide and conquer [3 marks]
- c) Write an algorithm for PUSH operation of a stack data structure [6 marks]
- d) Explain any three applications of search algorithms in computer science [6 marks]

Question Four

- a) Write a binary search algorithm that can be used to find a value in an array [8 marks]
- b) Implement the algorithm in (a) above to search for the value 15 in the below array

1	12	13	24	37	3	53	15	45	44
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[8 marks]

- c) Explain the following lines of code demonstrating list operation in a circular linked list.

[4 marks]

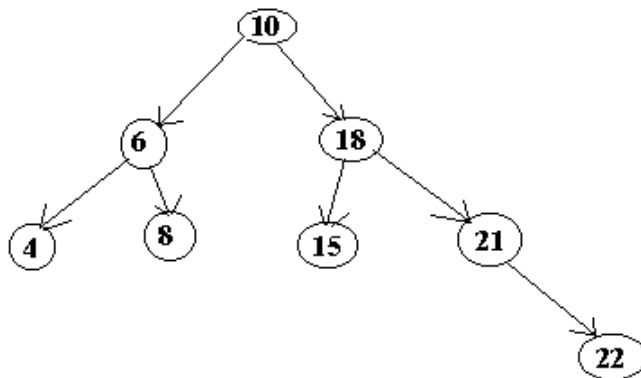
```
void printList() {
    struct node *ptr = head;
    printf("\n[ ");

    if(head != NULL) {
        while(ptr->next != ptr) {
            printf("(%d,%d) ",ptr->key,ptr->data);
            ptr = ptr->next;
        }
    }

    printf(" ]");
}
```

Question Five

Use the tree below to answer the following questions



- a) Insert nodes 7 and 10 into the tree above [3 marks]
- b) From the new tree formed after inserting nodes 7 and 10 in (i) above, delete node 6 [5 marks]
- c) Traverse the tree after deletion and indicate
 - i. Pre-order traversal [3 marks]
 - ii. In-order traversal [3 marks]
 - iii. Post-order traversal [3 marks]
- d) State and explain any three applications of linked lists in computer science [3 marks]