

**THARAKA**



**UNIVERSITY**

**COLLEGE**

**UNIVERSITY EXAMINATIONS  
EXAMINATION FOR THE AWARD OF BACHELOR OF SCIENCE IN  
COMPUTER SCIENCE**

**COSC 325: DATA STRUCTURES AND ALGORITHMS  
STREAMS: BSC COMP SCI Y3S1**

**TIME: 2 HOURS**

**DAY/DATE: WEDNESDAY 15/4/2020**

**8.30 AM – 10.30 PM**

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**INSTRUCTIONS:**

- Answer question **ONE** and **TWO** other questions
- Do not write anything on the question paper
- This is a **closed book exam**, no reference materials are allowed in the examination room
- There will be **NO** use of mobile phones or any other unauthorized materials
- Write your answers legibly and use your time wisely.

**SECTION A (ANSWER ALL QUESTIONS)**

**QUESTION ONE (30 MARKS)**

- a) Define the following terms.
- (i) Data (1mk)
  - (ii) Data type (1mk)
  - (iii) Data structure (1mk)
  - (iv) Abstract data structure (1mk)
  - (v) Algorithm (1mk)
- b) Explain in detail what you understand by the term “Analysis of an algorithm”. What issues are of concern? (5mrks)
- c) Given the array below answer the questions that follow

17	23	5	11	2	29	3
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- i) Briefly explain any two limitation of array as a building block of other data structures. (4mks)
- (ii) Diagrammatically represent how selection sort would be performed on the array data items. (10mrks)

(iii) Give the advantages and disadvantages of both selection and bubble sort algorithms. (6mrks)

**Question 2 (20 mrks)**

(a) Briefly describe the Queue data structure. (1mrk)

(b) Draw the symbolic representation of the Queue data structure after implementation of the following sequence of member function calls. (4mrks)

```
S.addQ(5);
S.addQ(17);
S.addQ(35);
S.removeQ();
S.addQ(53);
S.addQ(34);
S.removeQ();
S.removeQ();
```

(c) Describe the linked list implementation of a Queue. (5mks).

(d) Describe the array implementation of a queue. (5mks)

(e) Compare the Array and linked list implementation of a Queue in terms of (5mks)  
 (i) Insertion  
 (ii) Deletion  
 (iii) Search

**Question 3 (20 mrks)**

(a) Briefly describe the Stack data structure. (1mk)

(b) Draw the symbolic representation of the **stack** data structure after implementation of the following sequence of member function calls. (4mks)

```
S.push(5);
S.push(17);
S.push(35);
S.pop();
S.push(53);
S.push(35);
S.pop();
S.pop();
```

(c) Describe the linked list implementation of a Stack. (5mks)

(d) Describe the array implementation of a Stack. (5mks)

(e) Compare the Array and linked list implementation of a Stack in terms of: (5mks)

- (i) Insertion
- (ii) Deletion
- (iii) Search

**Question 4 (20 mrks)**

(a) Briefly describe the Binary Tree data structure. (2mks)

(b) Draw the binary search tree (BST) you get by inserting the following sequence into an initially empty tree (8mks)

13, 3, 4, 12, 14, 10, 5, 1, 8, 2, 7, 9, 11, 6, 18

(c) Briefly discuss two pre conditions for each of the following data structures (4mks)

- i. Stack
- ii. Queue

(d) Briefly discuss the following notations and give example in each case. (6mks)

- i) Prefix.
- ii) Infix.
- iii) Postfix.

**Question 5 (20 mrks)**

(a) Explain two direct application areas of each of the following data structures (8mks)

- (i) Stack
- (ii) Queue
- (iii) Linked list
- (iv) Tree

(b) For a tree data structure and using a suitable diagram, briefly explain the following concepts. (12mks)

- (i) Degree
- (ii) Level or depth of a node
- (iii) Descendant
- (iv) Leaf
- (v) Child
- (vi) Grandchild