UNIVERSITY EXAMINATIONS

EXAMINATION FOR SEPTEMBER/DECEMBER 2015/2016 FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE

RCCS 201 DATA STRUCTURES AND ALGORITHMS

DATE: 4/12/2015 **TIME: 2 HOURS**

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time.

This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.

Answer **Question 1 and any Other Two** questions.

QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE start the answer to EACH question on a NEW PAGE.**
2. **Keep your phone(s) switched off at the front of the examination room and NOT on your person.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.**
4. **ALWAYS show your working.**
5. **Marks indicated in parenthesis i.e. ( ) will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions , write the number of the question on the answer booklet(s) in the order you answered them.**
8. **DO NOT use your PHONE as a CALCULATOR .**
9. **YOU are ONLY ALLOWED to leave the exam room 30 minutes to the end of the Exam.**

SECTION A (Compulsory-30 MARKS)

QUESTION ONE [30 MARKS]

a) Define the following terms **[6 Marks]**
   I. Data Abstraction
   II. Information hiding
   III. Abstract data type (ADT)

b) Consider ADT(class) design for a rectangle
   I. Use an UML class diagram to rectangle design as an Abstract Data Type **[4 marks]**
   II. Develop a Java Interface file for ADT rectangle **[4 Marks]**
   III. Use a Sketch to show How a List may be implemented by use of an array **[6 Marks]**

c) Use Sketches and codes to show the implementation of the following Array Based List
   I. Insert **[5 Marks]**
   II. Delete **[5 Marks]**

SECTION B (Answer Any TWO questions -40 MARKS)

QUESTION TWO [20 MARKS]

a) For an ADT Stack , complete the following methods specifications

   I. **Public boolean push (Object newItem);**

/*Purpose: _____?

Pre-condition:_____?

Post-condition:_____?

*/ **[5 Marks]**

   II. **Public boolean pop();**

/*Purpose: _____?

Pre-condition:_____?

Post-condition:_____?

*/ **[5 Marks]**

b) Use a sketch to show how a stack can be implemented by use of an array **[5 Marks]**

c) Do a java implementation of the method **public boolean push (Object newItem)** for array based stack **[5 Marks]**

QUESTION THREE [20 MARKS]

a) For an ADT **queue** complete the following methods specification

Public Boolean enqueue(Object NewItem);

/*Purpose: _____?

Pre-condition:_____?

Post-condition:_____?

*/ **[5 Marks]**

public boolean dequeue ();

/*Purpose: _____?

Pre-condition:_____?

Post-condition:_____?

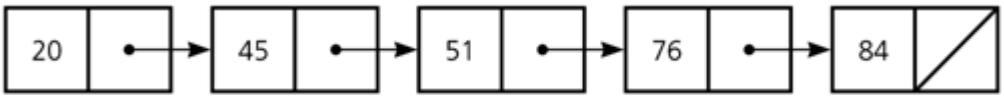
*/ **[5 Marks]**

b) Use a sketch to show how a queue can be implemented by use of an array **[5 Marks]**

c) Do a java implementation of the method **public boolean enqueue (Object newItem)** for array based queue **[5 Marks]**

QUESTION FOUR [20 MARKS]

a) The diagram below shows a sample linked list, use pointer sketch to demonstrate how to delete the third item on list



[5 Marks]

b) Construct a Binary Search Tree using the data : 60, 20,10,40,30,50,70 **[5 Marks]**

c) Write down algorithms for the following BST operations

I. BSTSearch() **[5 Marks]**

II. BSTInorderTraverse() **[5 Mark]**

QUESTION FIVE [20 MARKS]

List the factors to consider when designing a recursive solution **[5 Marks]**

a) Develop a recursive solution for the function Factorial(n) **[5 Marks]**

b) Sketch a simple interface user for a generic mobile phone **SMS** application and based on your sketch, write specifications for **four** methods/operations for an SMS system ADT

[10 Marks]