THE UNIVERSITY OF TRINIDAD & TOBAGO

FINAL ASSESSMENT/EXAMINATIONS JANUARY - APRIL 2016

Course Code and Title: DSAL 2001 Data Structures

Programme: BASc Computer Engineering

Date: Thursday 14th April, 2016 **Time:** 1:00pm – 4:00pm **Duration:** Three (3) Hours

PLEASE READ ALL INSTRUCTIONS CAREFULLY BEFORE YOU BEGIN THIS EXAMINATION

Instructions to Candidates

1. **This paper has 5 pages and 3 sections.**
2. **Section A has six (6) questions**
3. **Section B has three (3) questions**
4. **Section C has five (5) questions**
5. **You are required to answer All sections**

Key Examination Protocol

1. Students please note that academic dishonesty (or cheating) includes but is not limited to plagiarism, collusion, falsification, replication, taking unauthorized notes or devices into an examination, obtaining an unauthorized copy of the examination paper, communicating or trying to communicate with another candidate during the examination, and being a party to impersonation in relation to an examination.
2. The above mentioned and any other actions which compromise the integrity of the academic evaluation process will be fully investigated and addressed in accordance with UTT's academic regulations.
3. Please be reminded that speaking without the Invigilator's permission is **NOT** allowed.

SECTION A

1) Given the following numbers below:

13	28	14	16	12	8	20

Show the step by step configuration of the list after a Shell Sort algorithm has been applied to the list. **[5]**

2) Write a Java method that accepts an array of numbers and performs the Shell Sort algorithm on the argument list. **[5]**

3) You are asked to compare sorting 1000000 (1 million) values using quicksort and insertion sort.
   a. What is the order of algorithm for a quick sort? **[1]**
   b. What is the order of algorithm for an insertion sort? **[1]**
   c. Calculate how much faster the quick sort will be than the insertion sort. **[3]**

4) Write a Java recursive method that accepts a function parameter, say N, and returns the number of digits in N. The function header should resemble the following **[4]**

   a. int numdigits (int N)

5) Write a Java recursive Binary Search method that returns the position of a search key argument in the array argument. The method should accept the following parameters **[6]**
   a. **int binary Search (int list[], int lo, int hi, int search Key);**

6) Write a Java class that implements an Abstract Data Type called Queue using **static** storage mechanism. The class should define the following methods: **[10]**

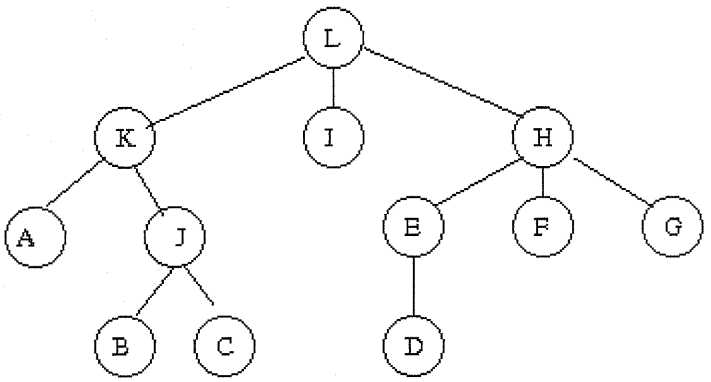
- init(); // Default size 10 // Prepares Queue for data
- init(int size); // Prepares Queue for data of a specified size
- add(Object obj); // Adds an object to the Queue
- Object remove (); // Removes and returns an object from the Queue
- boolean isEmpty(); // Returns true if the Queue is empty, false otherwise
- boolean isFull(); // Returns true if the Queue is full, false otherwise
- Object peek(); // Returns an object from the Queue but does not remove

SECTION B

1) 1. What is meant by the term collision with respect to hashing? [1]
2. Hashing is said to have a best case order of complexity of O(1). [1]
What does that mean?
3. What is primary clustering and give an example? [2]
4. One collision resolution technique is known as chaining.
Explain what is meant by chaining using a suitable example. [3]
5. Another collision resolution technique is a quadratic probe.
Using a suitable example explain the concept and benefit quadratic probe. [2]

6. What type of clustering is associated with a quadratic probe? [1]

2) Given the following tree perform



a) pre-order [4]
b) post-order [4]
c) Breadth first traversals of the tree. [4]

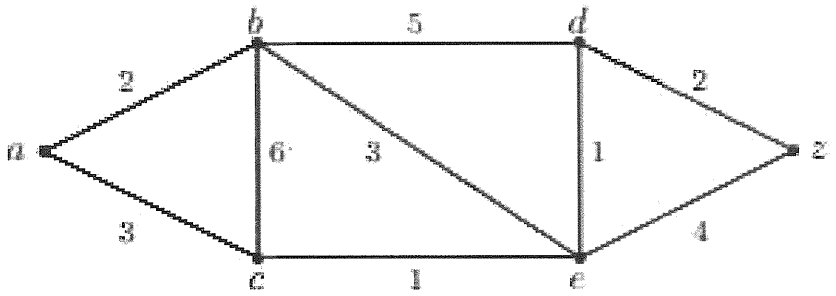
3) T is a binary tree of height 3

a. What is the largest number of nodes contained within T? [4]

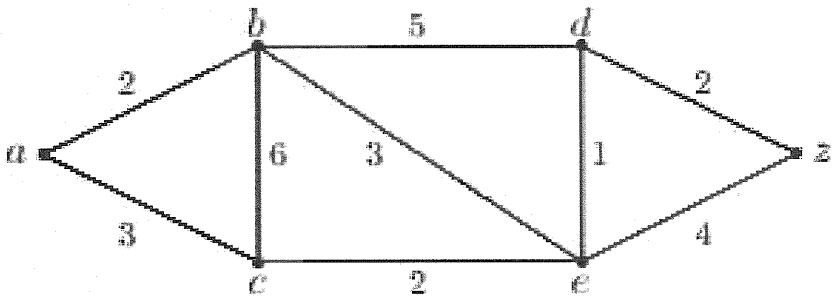
b. What is the smallest number? [4]

SECTION C

1) Use Dijkstra's algorithm to find the cost of the cheapest path between **a** and **z** in the following weighted graph **[10]**



2) Use Prim's algorithm to find a minimum spanning tree in the following weighted graph. Use alphabetical order to break ties. **[10]**



3) What is a heap? **[2]**

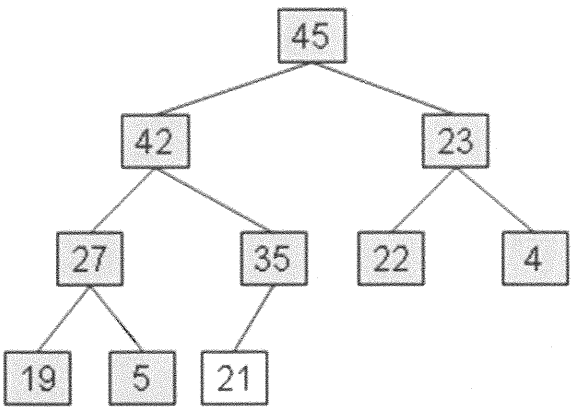
Given the following array draw an almost complete binary tree (not to be confused with a binary search tree) using a level order traversal implementation. **[2]**

Explain how a level order traversal works. **[1]**

15, 19, 10, 7, 17, 6

4) With the created binary tree convert it to a max heap. **[5]**

5) Remove the root element of the heap in the diagram and redraw the new max heap tree. **[5]**



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