UNIVERSITI KUALA LUMPUR
Malaysian Institute of Information Technology

FINAL EXAMINATION
JANUARY 2016 SESSION

SUBJECT CODE	:	ISB30503
SUBJECT TITLE	:	DATA STRUCTURES AND ALGORITHMS
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00 am – 11.30 am (2 ½ HOURS)
DATE	:	23 MAY 2016

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of FIVE(5) questions.
4. Question 1, 2 and 3 are COMPULSORY, choose ONE(1) question from question 4 or 5.
4. Please write your answers on the answer booklet provided.

INSTRUCTION: Answer FOUR questions only. Questions 1, 2 and 3 are compulsory, and choose ONE question from questions 4 or question 5.

Question 1

a. Collections Framework provides unified architecture for manipulating and representing collections.

i. State **TWO** benefits of Collections Framework. (4 marks)

ii. State **ONE** class in the framework that uses Iterator interface. (2 marks)

b. Write the output from the following program segments:

i.
```
ArrayList<String> name = new ArrayList<String>();
name.add("abu");
name.add ("amin");
name.add("anas");
name.add(1, "ali");
name.set(2,"ahmad");
int index = name.indexOf("anas");
name.remove(index-2);
System.out.print(name);
```
(4 marks)

ii.
```
LinkedList<Integer> alist = new LinkedList<Integer>();
ListIterator<Integer> itr ;
alist.add(5);
alist.add(9);
alist.add(4);
itr = alist.listIterator(1);
itr.next();
itr.set(8);
itr.add(6);
System.out.println(alist);
```
(4 marks)

c. Consider the following algorithms to determine whether anyone has the same age as you.

Algorithm 1: You say it loud your age and ask whether anyone in the class has the same age as you.

Algorithm 2: You ask the first person in the class whether his/her age is the same as you; if the answer is *No*, you will proceed asking the same question to the second person in the class, and if the answer is still a *No*, you will continue asking the next person in the class until a *Yes* is obtained.

i. State the factor that affects the number of questions asked (the "problem size") in Algorithm 2.

(2 marks)

ii. In the worst case, how many questions will be asked for **each** algorithm.

(2 marks)

iii. State the algorithm efficiency or running time for **each** algorithm.

(3 marks)

iv. If Algorithm 3 exists and it is written as below, derive the f(n) and the Big O of the algorithm.

```
for (x = 1; x <= n; x = x+1)
{    user input;
     if  input  = "yes" then
          exit from the loop;
}
```

(4 marks)

Question 2

a. State the characteristics of a Binary Search Tree.

(4 marks)

b. Show the step by step insertion of these integer values in a Binary Search Tree (BST): 6, 5, 2, 9, 2, 1

(3 marks)

c. Referring to your answer in 2(b), traverse the BST using preorder and postorder traversal.

(6 marks)

d. Draw the AVL tree that would result from inserting into an empty tree the following elements : *melaka, turki, syria, mesir, morocco, jeddah.*

(12 marks)

Question 3

a. Show the final MaxHeap after implementing the following instructions:

```
Heap<Integer> isHeap = new Heap<Integer>( );
   isHeap.add (33);
   isHeap.add (55);
   isHeap.add (44);
   isHeap.add (66);
   isHeap.add (77);
```

(8 marks)

b. Briefly discuss the steps to delete a node in a BST.

(7 marks)

c. Binary Search Tree (BST) is found to be an advantage when searching an item. Provide example to support your answer.

(6 marks)

d. State the differences between an AVL Tree and a Heap.

(4 marks)

Question 4

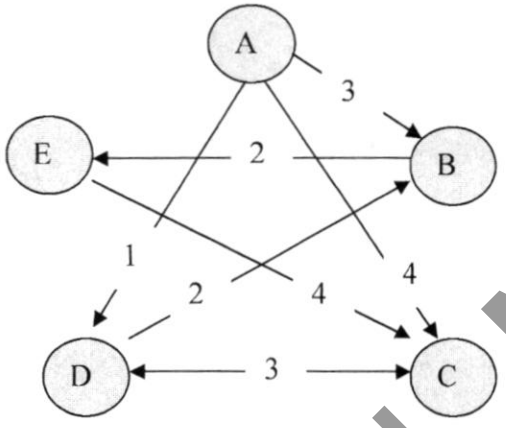
a. Draw a picture of the following undirected graph.

Vertices: A B C D E

Edges: {A B} {C D} {D A} (B D} {B E}

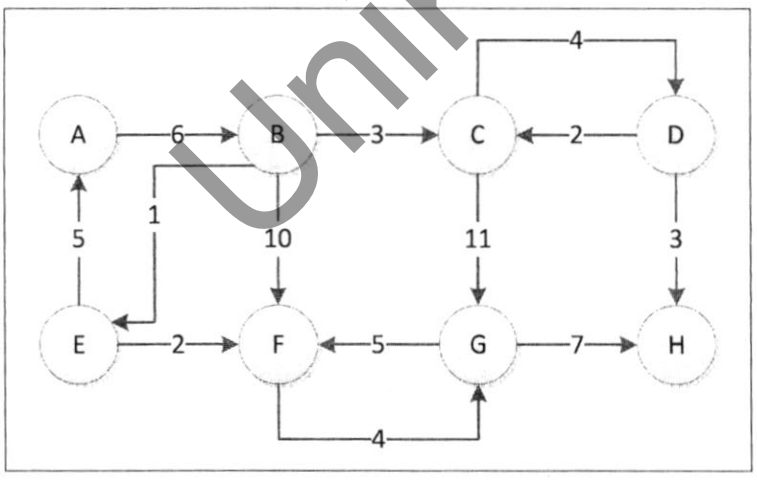
(5 marks)

b. Produce the adjacency list of the following graph.



(6 marks)

c. The following questions are based on the graph below:



i. List all possible paths (without cycle) from A to H.

(4 marks)

ii. Based on your answer in 4c(i) above, find the shortest path and its length.

(1 mark)

iii. Find all distinct cycles.

(3 marks)

iv. Draw the adjacency matrix.

(6 marks)

Question 5

a. Suppose that 9 1 8 6 4 5 represents an array of Integer objects.
Show the steps to sort this array using:

i. Selection sort algorithm

(6 marks)

ii. Insertion sort algorithm

(6 marks)

b. Discuss the differences between the two sorting techniques in 5(a) above.

(3 marks)

c. The following questions are around the topic "ArrayList vs LinkedList".

i. Give **TWO** differences between the two structures.

(4 marks)

ii. Suggest the best time to use **each** structure.

(4 marks)

iii. State the initial capacity of **each** structure.

(2 marks)

END OF QUESTION