UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2014/2015 – 2nd Year Examination – Semester 4

IT4105 – Programming II

Part 2 - Structured Question Paper

1st August, 2015
(ONE HOUR)

To be completed by the candidate

BIT Examination Index No: .....

Important Instructions:

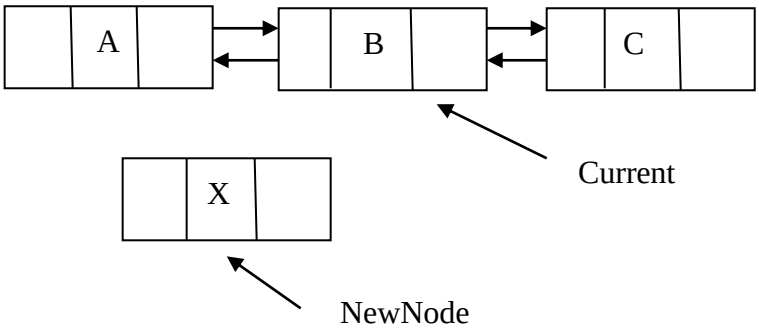
- The duration of the paper is **1 (one) hour**.
- The medium of instruction and questions is English.
- This paper has **2 questions** and **16 pages**.
- **Answer both questions.**
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.

Questions Answered

Indicate by a cross (×), (e.g. [X]) the numbers of the questions answered.

	Question numbers			
To be completed by the candidate by marking a cross (×).	1	2		
To be completed by the examiners:				

1) (a Consider the following diagram and the ListNode class data structure definition.




```
Class ListNode
{
    Object ListNode;
    ListNode=next;
    ListNode=previous
}
```

Write down a Java Code or Pseudo Code to perform the following independent operations. Your answer should also be supported along with suitable diagrams.

(i) Describe, how the element "X" is inserted immediately before the Element "B".

[3 Marks]

ANSWER IN THIS BOX

(ii) Describe how the element "X" is inserted immediately after the element "B" in the initial list.

[3 Marks]

ANSWER IN THIS BOX

(iii) Describe, how you can delete the element "B" from the initial list.

[3 Marks]

ANSWER IN THIS BOX

(iv) You may assume that the above doubly linked list consist of the header and the tail node to indicate both ends. What is the relationship between the header and the tail if the doubly lined list is empty?

[3 Marks]

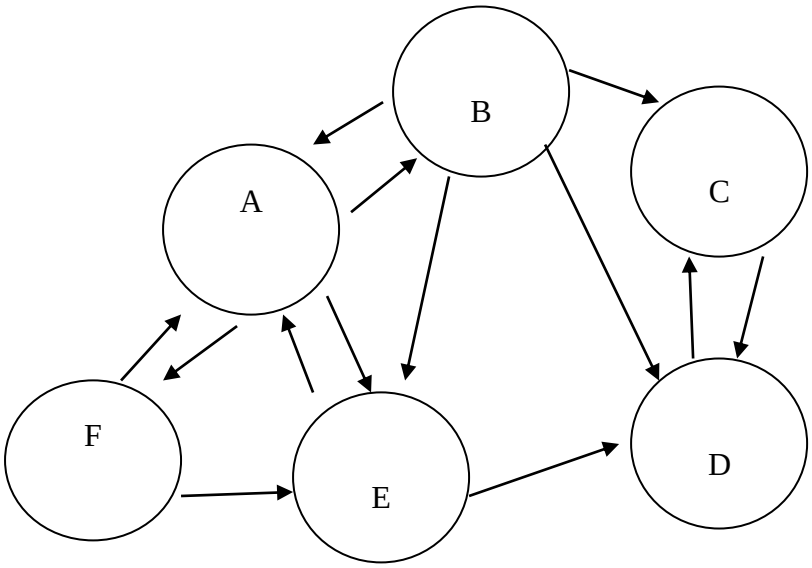
ANSWER IN THIS BOX

(b (i) Define the terms Cyclic Path, Adjacency Matrix and Path Matrix used in Directed Graphs.

[3 Marks]

ANSWER IN THIS BOX

Consider the following directed graph. It shows the name of cities and the possible paths from one city to another. The graph is labelled Graph P.



Graph P

(ii) Find the Adjacency Matrix of Graph P.

[3 Marks]

ANSWER IN THIS BOX

(iii) How would you represent the above directed graph P using a linked list representation? You should use a suitable diagram to answer the question.

[3 Marks]

(iv) Traverse the above directed graph in Breadth First Traversal Order using a queue. Show the final answer with intermediate results.

[4 Marks]

ANSWER IN THIS BOX

2) (a) Consider the following binary search tree as shown in Figure H:

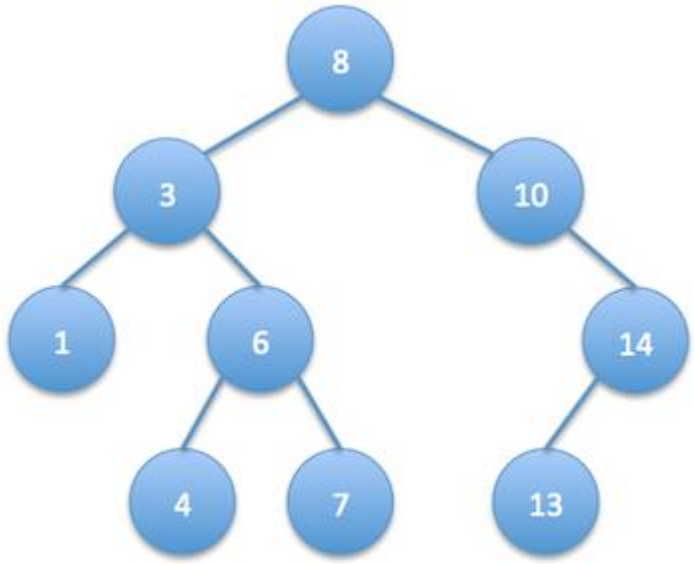


Figure H: Binary Search Tree

(i) Write down the order of nodes visited for the tree if the tree is traversed in the following sequence.

- Pre-order
- In-order
- Post-order

[3 Marks]

ANSWER IN THIS BOX

(ii) One wants to find the maximum value from the above binary search tree in a recursive manner. You have been assigned to do this task and hence you are required to develop a recursive algorithm to find the maximum from any binary search tree. Using the proposed algorithm, illustrate how you could find the maximum value from the above tree.

[4 Marks]

(iii) Write a JAVA code to find the maximum value from a binary search tree in a recursive manner.

[4 Marks]

ANSWER IN THIS BOX

(iv) How could you modify Part (ii) above to find the maximum value in non-recursive manner? You should include the appropriate pseudo code or Java code.

[3 Marks]

ANSWER IN THIS BOX

(v) Consider the following pseudo code algorithm:

```
1. add(T, v, e){
2. if(T.isLeaf(v)){
        if(v.element()>=e)
            add element e as v's left child
        else
            add element e as v's right child
3. } else {
        if(v.element()>=e)
            add(T, T.leftChild(v), e)
        else
            add(T, T.rightChild(v), e)
4. }
5. }
```

One wants to insert node 9 to Graph H. Describe how you could insert the node according to the steps (step shows the line numbers of the pseudo code) in the algorithm above?

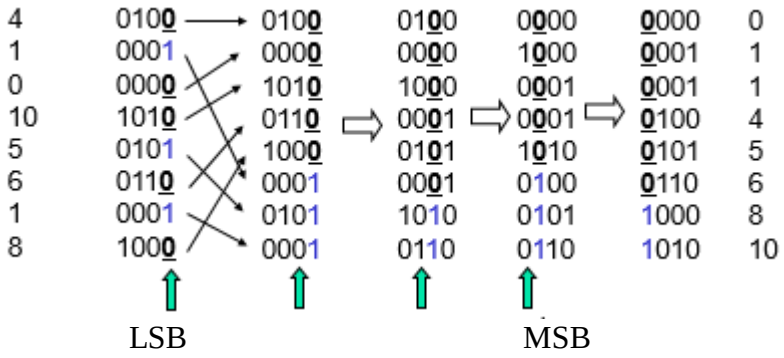
[4 Marks]

ANSWER IN THIS BOX

(b) One wants to sort N numbers using the radix sort algorithm. You may that assume that each number has k-bits. For example, one can consider the following data set.

Input :{ 4, 1, 0, 10, 5, 6, 1, 8}

The above data set can be sorted using the straight radix sort as below.



Write a suitable pseudo code algorithm or Java code to sort any given integer data set using the methodology described above.

[4 Marks]

ANSWER IN THIS BOX

(c) Draw the **final binary min heap** that results after inserting: 95, 16, 7, 59, 21, 45, 06, and 4 into an initially empty binary min heap in the given order. Show **only** the final heap. Intermediate heaps are not required.

[3 Marks]

ANSWER IN THIS BOX

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