UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2019 – 2nd Year Examination – Semester 4

IT4105: IT Programming II

Part 2 - Structured Question Paper
23rd November 2019
(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 **09 pages**.

- **Answer all questions.** All questions carry similar marks.

- **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. ✗) the numbers of the questions answered.

	Question numbers			
To be completed by the candidate by marking a cross (✗).	1	2	3	
To be completed by the examiners:				

1) a) Convert the following infix expressions into postfix expressions.

   (i)   (A–B) * (C+D)
   (ii)   (A + B) / (C + D) – (D * E)
   (iii) (A + B) * C

(6 Marks)

ANSWER IN THIS BOX

(i) [AB-]*[CD+]
         AB-CD+*

(ii) (A + B) / (C + D) – (D * E)
      [AB+]/[CD+]-[DE*]
      [AB+][CD+]-[DE*]/
      AB+CD+/-DE*

(iii)(A + B) * C
      ([AB+)*C
      AB+C*

b) Evaluate the following postfix expression using a stack.

9 4 7 + - 9 + 2 *

Note: All steps of the evaluation process should be shown in the following table.

(5 Marks)

Index No ………………………….

ANSWER IN THIS BOX

Step	Input Symbol	Action /Operation(s)	Stack status	Intermediate output	
1	9	Push	9		
2	4	Push	9 4		
3	7	push	9 4 7		
4	+	Pop twice and perform the addition	9	4+7=11	
5	11	push	9 11		
6	-	Pop twice and perform the subtraction		9-11=-2	
7	9	push	-2 9		
8	+	Pop twice and perform the addition		-2+9=7	
9		Push	7		
10	2	push	7 2		
11	*	Pop twice and perform the multifaction		7 * 2=14	
12	14	Push	14		
		No more elements		14	

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(c) Write pseudocode algorithms/Java code to implement two basic queue operations Enqueue and Dequeue using a **maximum of two stacks for each**.

(4 Marks)

ANSWER IN THIS BOX

enQueue(q, x):

Step 1: While stack1 is not empty, push everything from stack1 to stack2.
Step 2:Push x to stack1 (assuming size of stacks is unlimited).
Step 3: Push everything back to stack1.

Or equivalent

DeQueue(q):

Step 1:If stack1 is empty then error
Step 2: Pop an item from stack1 and return it

Or equivalent

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d) Consider the following singly linked list (shown in Figure 1) with given references.
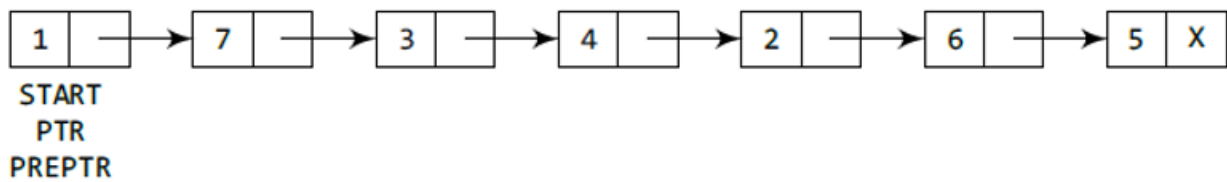
Figure 1: Singly Linked List

Note 1: The following class structure can be used for your convenience.

```
/* Linked list Node*/
   class Node {
      int data;
      Node next;
```

Note 2: START, PTR, and PREPTR point to the first element in the linked list.

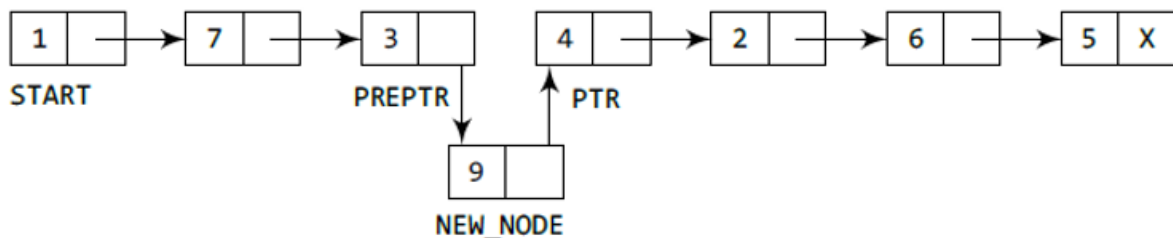One wants to insert a new node (referenced as NEW_NODE with data content as 9) as shown in Figure 2.

Figure 2: Intermediate diagram

After the above insertion, the final liked list should be as follows (shown in Figure 3).
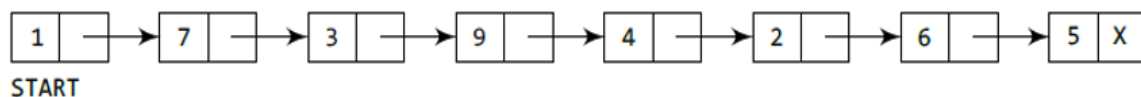

Figure 3: After completion of the insertion

Write down the necessary pseudocode algorithm or Java code segment to implement the above-mentioned insertion using only the references given.

(6 Marks)

ANSWER IN THIS BOX

Step 1: NEW_NODE->data=9
Step 2: SET PTR=START
Step 3: PREPTR = PTR
Step 4: REPEAT STEPS 5 AND 6 while PREPTR->DATA=3
Step 5: SET PREPTR=PTR
Step 6: SET PTR=PTR->NEXT
      [END OF THE LOOP]
Step 7 : PREPTR->NEXT=NEW_NODE
Step 8 : NEW_NODE->NEXT=PTR

Or alternative answer

NEW_NODE.NEXT = PTR
PREPTR.NEXT = NEW_NODE
NEW_NODE.DATA =9

e) Write a pseudo-code algorithm or java code segment to delete the first node from the linked list given in Figure 1 above.

(4 Marks)

ANSWER IN THIS BOX

Step 1: SET PTR=START

Step 2: SET START= START->NEXT

Step 3 dispose PTR

OR equivalent java code

2) (a) Consider the following function.

```
function (int n)
{
    if (n==1)
        return;
    for (int i=1; i<=n; i++)
    {

        for (int j=1; j<=n; j++)
        {
            printf("*");
            break;
        }
    }
}
```

Find the time complexity of the above program:

(4 Marks)

> **ANSWER IN THIS BOX**
>
> Time Complexity of the above function is O(n).
>
> Note: Even though the inner loop is bounded by n, but due to break statement it is executing only once. // Inner loop executes only one   // time due to break statement.

b)

A student wants to sort eight integers using the quicksort algorithm, and he/she has completed the first partitioning. After the first partitioning, the intermediate array is represented as follows.

3 8 2 6 9 10 73 27

What is/are the most suitable pivot value(s) chosen by the student to obtain the above intermediate array?

(5 Marks)

ANSWER IN THIS BOX

The pivot could be either the 9 or the 10

c) What is special about the in-order traversal of a binary search tree?

ANSWER IN THIS BOX

It traverses in an increasing order

(As a binary search tree consists of elements lesser than the node to the left and the ones greater than the node to the right, an in-order traversal will give the elements in an increasing order)
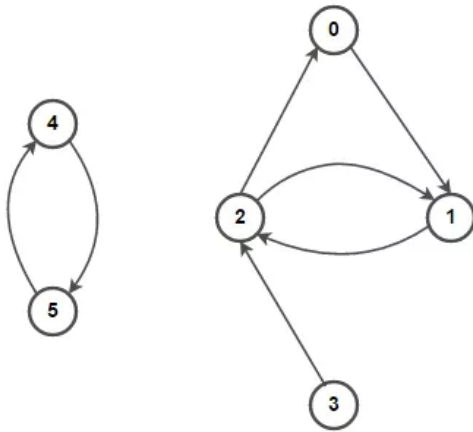
(5 Marks)

d) Create an AVL tree with the following values and draw the **final answer** in the given answer box.

```
15, 20, 24, 10, 13, 7, 30, 36, 25
```

(6 Marks)

ANSWER IN THIS BOX
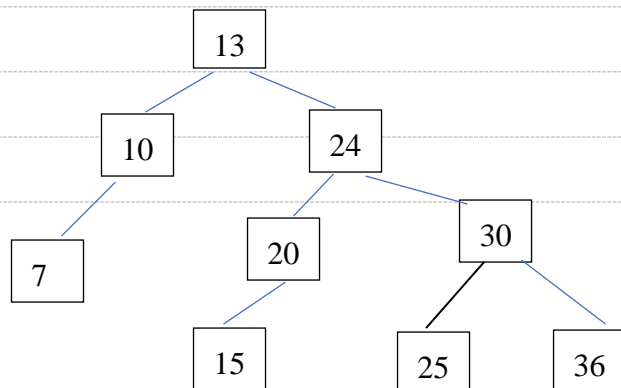
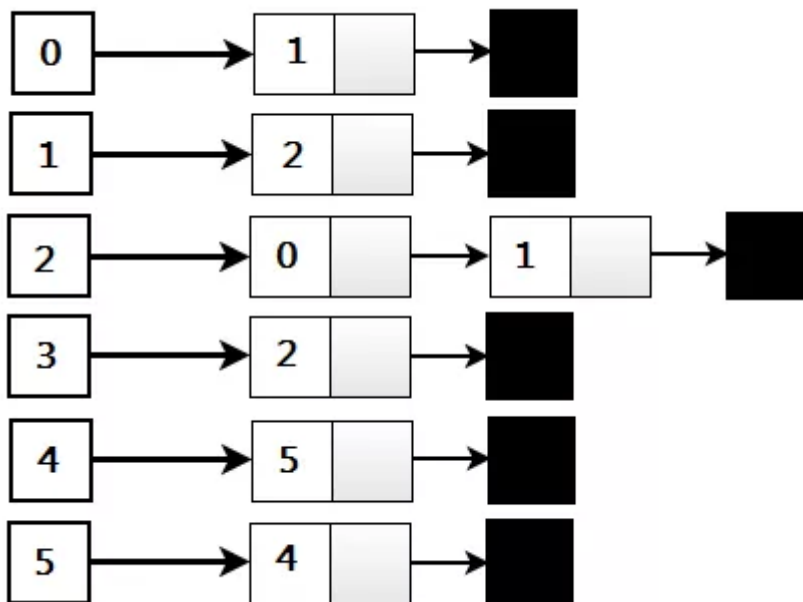**(e)** Consider the following directed graph.

Write down the **adjacency list representation** of the above graph.

Note: An adjacency list representation for a graph associates each vertex in the graph with a collection of its neighboring vertices or edges.

(5 Marks)

ANSWER IN THIS BOX

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