UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2017 – 2nd Year Examination – Semester 4

IT4105: IT Programming II

Part 2 - Structured Question Paper

18th November, 2017

(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.** Both questions carry equal 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. [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:			

Index No …….

1)

a) How will you implement a queue using two stacks? You may use a pseudo code or java code to explain the answer.

(4 Marks)

ANSWER IN THIS BOX

```
Function queuepush(obj)
  Stack.push(obj)
Function queupop()
  If stack2 is empty
    If stack1 is empty
      Return null
   While stack1 not empty
     Stack2.push(stack1.pop())
   Return stack2.pop()
```

Or similar equivalent code

b) One wants to add 423 and 3867 using stacks.

(i) If one uses three (03) stacks to perform the above addition, what would be the top element in the resulting stack at each intermediate steps during the addition.

(4 Marks)

ANSWER IN THIS BOX

0,1,1,8

(ii) When performing the addition, one uses a single integer variable to store the remainder. What would be the remainder value at each intermediate step in the addition process?

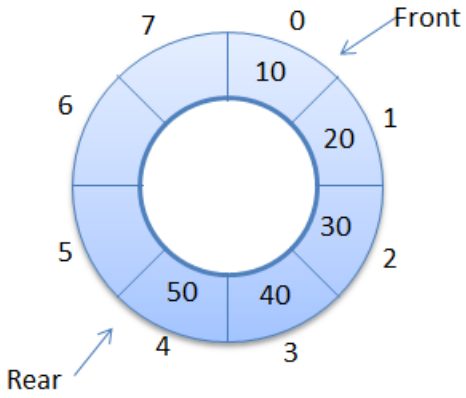
(3 Marks)

ANSWER IN THIS BOX

1,1,1

c)

Consider the following circular queue with initial values given below.



Initails values are :
Front=0
Rear=4
Count=5

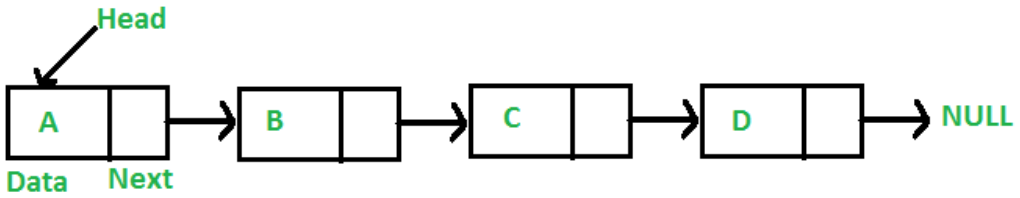
One wants to delete a node from the above circular queue. What are the parameter values (Front, Rear and Count) after the deletion?

(4 Marks)

ANSWER IN THIS BOX

Front=1, Rear=4, Count=4

d) Write a Java code or pseudo code algorithm to search a particular item from the following singly linked list using the following diagram to answer the question.



(5 Marks)

ANSWER IN THIS BOX

1) Boolean search(Node ,head, int x)

2) Initialize a node pointer, current = head.

3) Do following while current is not NULL

a) current->key is equal to the key being searched return true.

b) current = current->next

4) Return false

e) Write a Java code or pseudo code algorithm to find the length of a singly linked list.

(5 Marks)

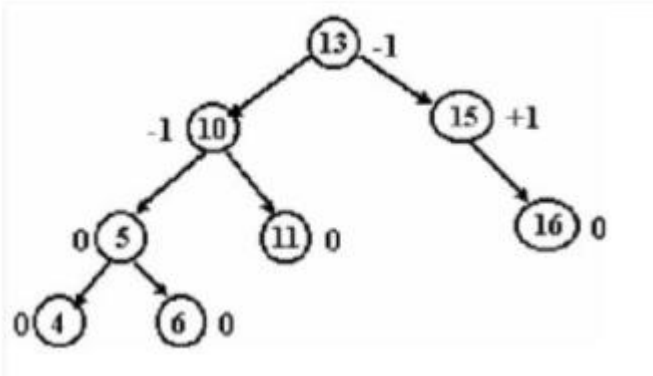
ANSWER IN THIS BOX

```
public int length(){
  int count=0;
  Node current = this.head;
  while(current != null)   {
    count++;
    current=current.next()
   }
 return count;
}

)
```

or equivalent version

2) (a) Consider the following AVL tree.



If one inserts the following nodes to the above tree in the following order

- 14
- 3
- 45
- 7

how many

(i) Single rotations

(ii) Double rotations are needed to maintain the AVL properties?

(4 Marks)

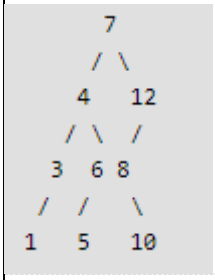
ANSWER IN THIS BOX
(i) 2
(ii) 1

b) Construct the BST (Binary Search Tree) using the following given numbers. Final BST is sufficient for the answer

7, 4, 12, 3, 6, 8, 1, 5, 10

(3 Marks)

ANSWER IN THIS BOX



c) Write a recursive Java code or pseudo code algorithm to find the **minimum key value** from a Binary Search Tree.

(4 Marks)

ANSWER IN THIS BOX

```
Recursive findmin
If (t = = null)
return null;
else if (t.left= = null)
return t;
return findMin(t.left);
```

d) T is a min heap of height 3. What is the largest number of nodes that T can have? What is the smallest number?

(3 Marks)

ANSWER IN THIS BOX

The first three levels (including the root) must be fully filled out, giving a total of 7 nodes. The 4th level has between 1 node and 8 nodes. So largest number is 15 and smallest number is 8.

Answer : largest is 15 and smallest is 8

e) Show the result of running the partition subroutine of quicksort on the following array, assuming that the index of the pivot is chosen to be 0 (the pivot is A [0] =23). What value does the partition return?

A=[23, 2, 35, 27, 6, 17, 49, 7, 22, 33]

(3 Marks)

ANSWER IN THIS BOX

[2, 6, 17, 7, 22, 23, 35, 27, 48, 33]. The value returned is 5 (the index of 23).

f) How many pivot values are needed to sort the above array A.?

(3 Marks)

ANSWER IN THIS BOX

6 pivot values

g) Consider the merge sort algorithm given below.

MergeSort(ARR[], L, R)
If R > L

1. Find the middle point to divide the array into two halves:
middle M = (L+R)/2

2. Call mergeSort for first half:
Call mergeSort(ARR, L, M)

3. Call mergeSort for second half:
Call mergeSort(ARR, M+1, R)

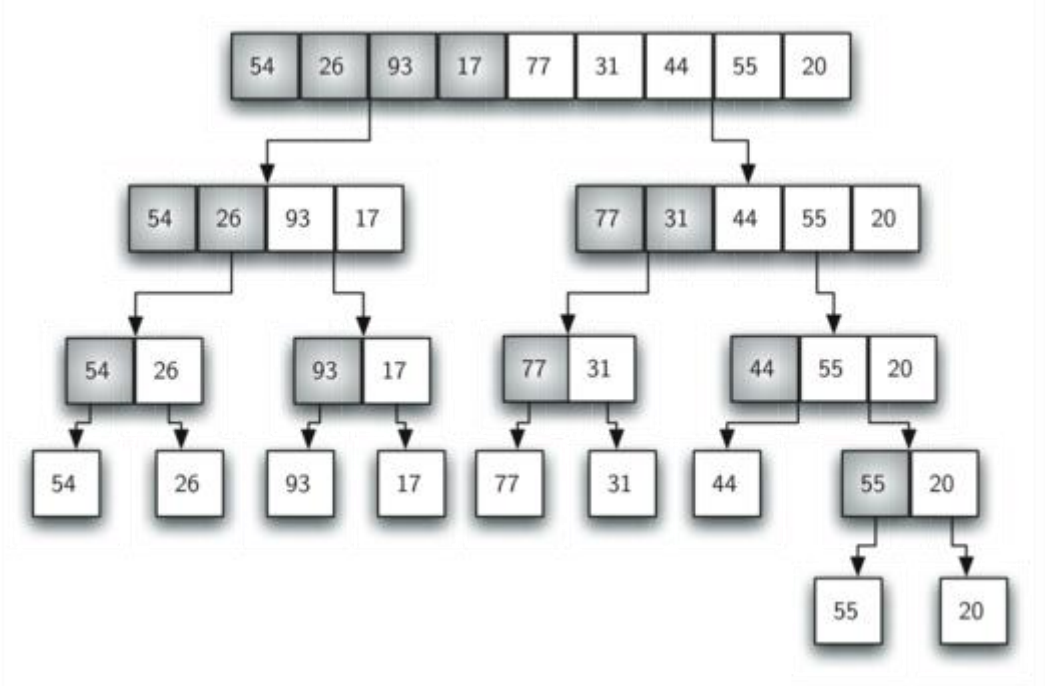
4. Merge the two halves sorted in step 2 and 3:
Call merge(ARR, L, M, R)

Note: L is the index of the left most element in the array.
R is the index of the right most element the array.

According to the above algorithm, describe, how merge sort algorithm works on the following data set : { 54,26,93,17,77,31,44,55,20}

[5 Marks]

ANSWER IN THIS BOX



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