UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2016 – 2nd Year Examination – Semester 4

IT4105: IT Programming II

Part 2 - Structured Question Paper

1st October, 2016

(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 **11 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. [X]) 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:				

Index No …….

1) Consider the following diagram, named as Figure 1

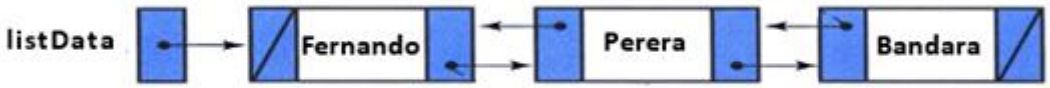


Figure A

a) Propose a suitable class structure to define the above doubly linked list. You may use forward and backward references using the keywords **next** and **prev** respectively.

(3 Marks**)**

ANSWER IN THIS BOX

```
Class Node
{
    Object data //some element ;
    Node next ;
    Node  prev ;
}
```

Or equivalent

b) Write down an appropriate Java code segment or pseudo code segment, if one wants to insert a new node (data as Silva and reference as newNode) to the above original list as shown in Figure B. You may use given references.

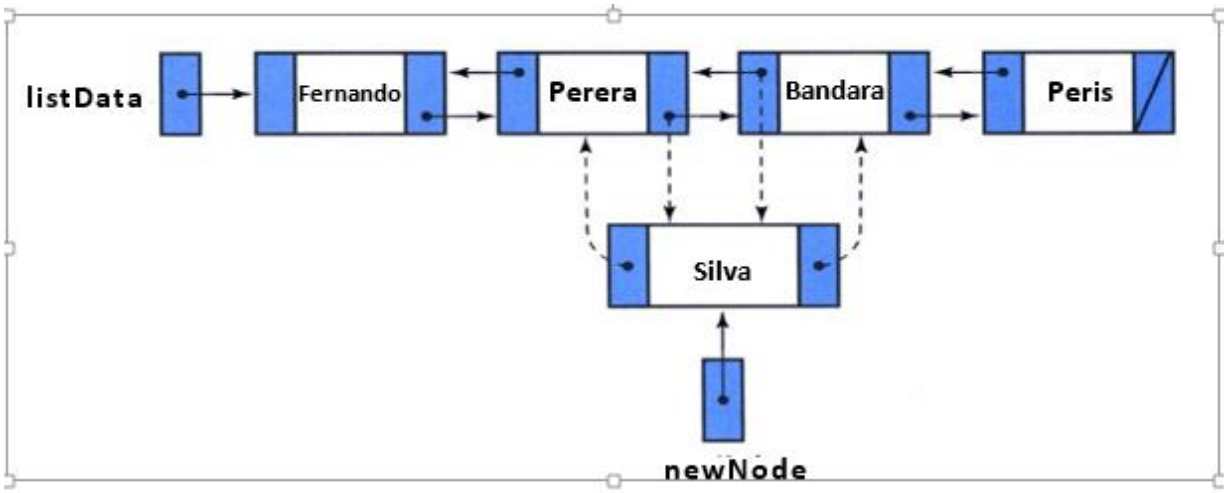


Figure B

(4 Marks)

ANSWER IN THIS BOX

```
newnode.next=listdata.next.next ;
newnode.prev=listnode.next.next.prev ;
listnode.next.next.prev=newnode ;
listnode.next.next=newnode ;
```

c) Consider the following diagram named as Figure 3

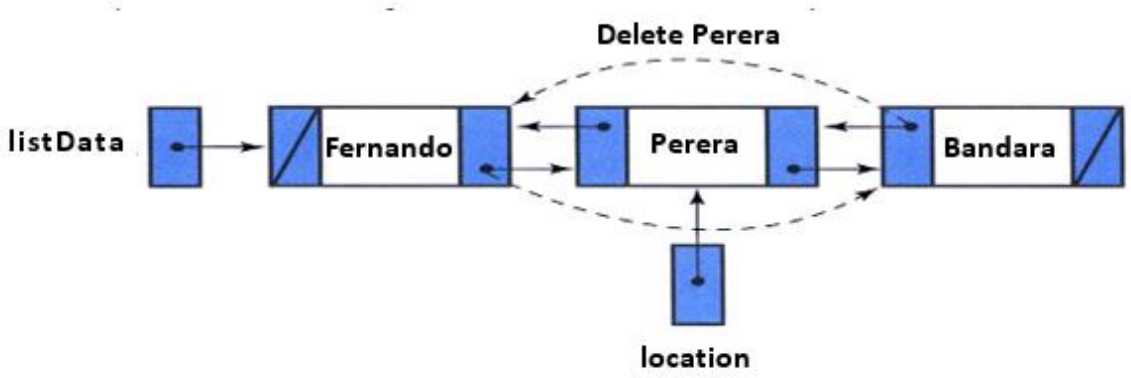


Figure C

Write down the appropriate Java code segment or pseudo code segment, to delete the node with data as Perera and reference as location as shown in Figure C.

(4 Marks)

Location.prev.next-location.next
Location.next.prev=location.prev

d) Write a Java code or pseudo code algorithm to search a particular item from the doubly linked list. You may use Figure A to answer the question.

(4 marks)

ANSWER IN THIS BOX

```
you may take search item as x
flag=0
haed=listdata
while head. next !=null and flag=0
{
      if head.data=x then
        flag=1
      else
      head=head.next
}
if  flag=1 then
   print (‘ serach successful)
else                                                    continued..
```

```
    print(‘ search is unsuccessful)
```

or equivalent version

e) Memory management is an important function of an operating system. First fit algorithm is one of Memory management Algorithms. Consider the following scenario in relation to the First fit algorithm used in memory management.

Each user processors (user jobs) request a particular size of memory that must be available contiguously (one block) large enough to fit the memory and then allocate the process. If that memory partition is too large to accommodate the process, the memory block is divided into two parts. One to accommodate the process and the other one is kept as a free space block (hole). When a process (job) terminates, its allocated block of memory becomes free space block (hole).

If one assume the memory size is 4GB (4096 MB) and 1GB is allocate for the operating system files and the remaining memory is reserved for user processors. The memory allocation and de-allocation (termination) are performing in the following fashion.

- Allocate 512 MB memory to process A
- Allocate 256 MB memory to process B
- Allocate 128 MB memory to process C
- Terminate process B
- Allocate 256 MB memory to Process D
- Terminate Process A

(i) Propose a suitable data structure to implement the above scenario.

(2 Marks)

Linked list representation

Index No ……

(ii) Define the Java class structure for the data structure proposed in Part (i) above.

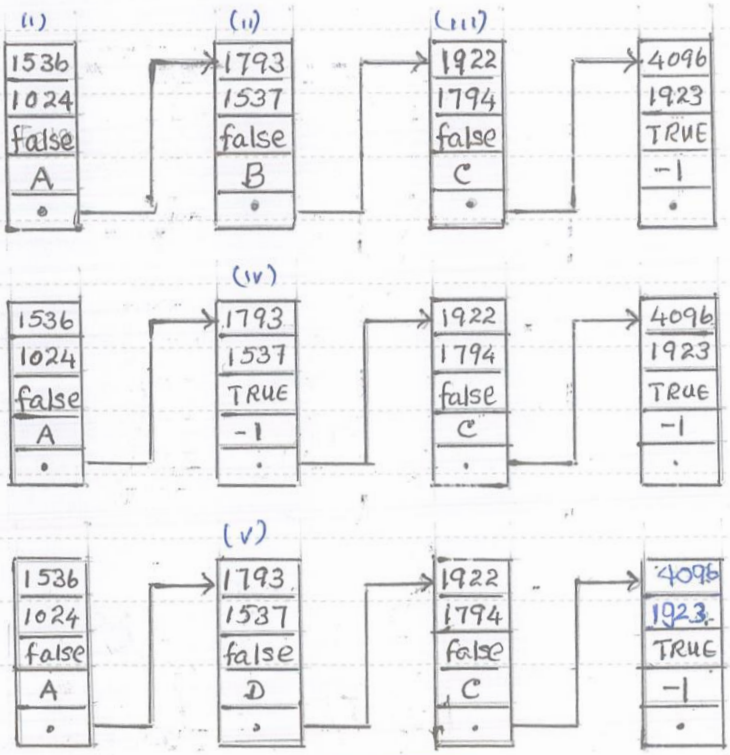
(4 Marks)

```
Partition class needs to be created for this purpose,
Public class partition
{
    ini beginaddress;
    int endaddress;
    boolaen hole // hole is false, if it is occupied by a process , true otherwise
    Int processId // if hole is false, it contains the process identifier of the process
    using the partition, otherwise -1
```

(iii) Using a suitable diagram show how the above operations are performed with the appropriate partitions.

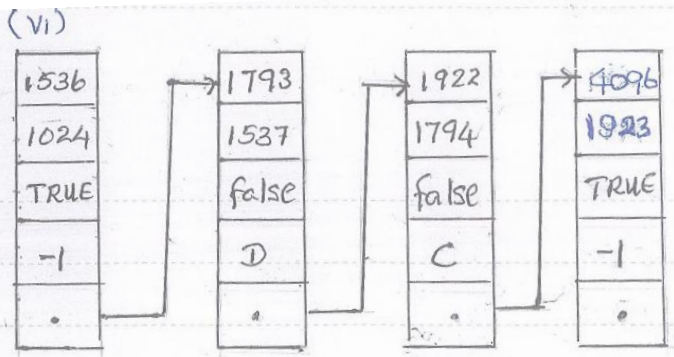
(4 marks)

ANSWER IN THIS BOX



Continued….

(vi)



2 a) Write down the recursive definition of finding the sum of n positive integer values mathematically.

(2 Marks)

ANSWER IN THIS BOX

recursive mathematical definition:

sum(n) = 1 if n = 1 (Base case)

= n + sum(n-1) if n > 1 (Recursive call)

ANSWER IN THIS BOX

```
int sum(int n)
{
  if (n == 1)                  // base case
    return 1;
  else
    return n + sum(n-1);          // recursive call A
}
```

c) Write a recursive pseudo code algorithm to implement a breadth first traversal in a tree.

(4 Marks)

ANSWER IN THIS BOX

```
Breadthfirsttraversal (Node T) {      //or pre-order traversal
        If (T!=null) {
            T.visit()  // or print the content
            Breadthfirsttraversal(T.left)
            Breadthfirsttraversal(T.right)
          }
  }
```

d) Consider the following list with two sub files. The first sub file (enclosed with round brackets) represent the sorted sub-file and the second sub file (enclosed with round brackets) represent the unsorted sub-file. For each list, state how many comparisons and swaps are needed to sort the next number in the second sub file?

(i) [(1 4 5 8 9) (6 2)]
(ii) [(1 5) (2 6 19 11)]
(iii) [(1 3 9 25) (2,7)]
(iv) [1 2 3 8) (5 4)]
(v) [(2 3 4 6 7 8 9) (1)]

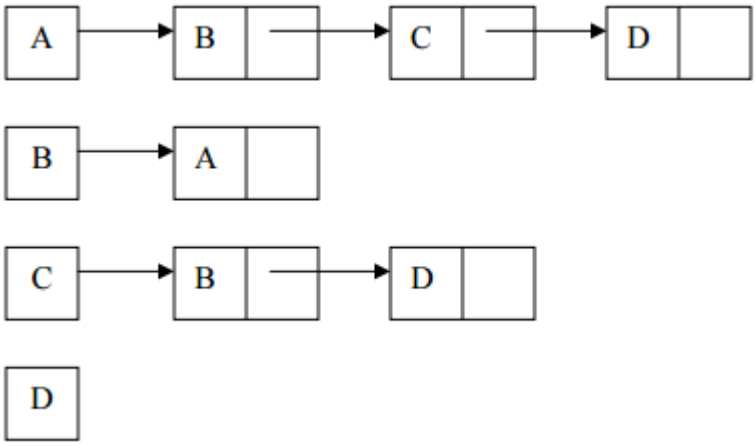
(5 Marks)

ANSWER IN THIS BOX

(i) 3 comparisons , 2 swaps
(ii) 2 comparisons , 1 swaps
(iii) 4 comparisons, 3 swaps
(iv) 2 comparisons, 1 swaps
(v) 7 comparisons, 7 swaps

Consider the following adjacency list representation of a directed graph where there are

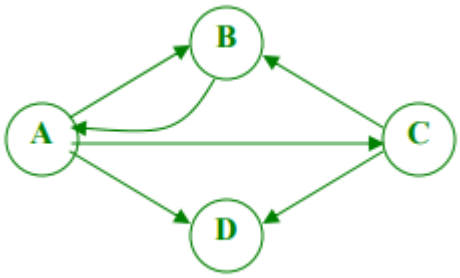
e) no weights assigned to the edges.



(i) Draw a directed graph to illustrate the above adjacency list representation

(2 Marks)

ANSWER IN THIS BOX



(ii) Find the adjacency matrix for the above adjacency list representation.

(3 Marks)

ANSWER IN THIS BOX

	A	B	C	D
A	0	1	1	1
B	1	0	0	0
C	0	1	0	1
D	0	0	0	0

(iii)Determine the path matrix (transitive closure*)* using matrix operations

(5 Marks)

ANSWER IN THIS BOX

	A	B	C	D
A	0	1	1	1
B	1	0	0	0
C	0	1	0	1
D	0	0	0	0

ADJ

	A	B	C	D
A	1	1	0	1
B	0	1	1	1
C	1	0	0	0
D	0	0	0	0

ADJ_2

	A	B	C	D
A	1	0	1	1
B	0	1	0	1
C	0	1	1	1
D	0	0	0	0

ADJ_3

	A	B	C	D
A	1	1	0	1
B	0	1	0	1
C	1	0	0	0
D	0	0	0	0

ADJ_4

	A	B	C	D
A	1	1	1	1
B	1	1	1	1
C	1	1	1	1
D	0	0	0	0

path

Calculate adj
Adj2=adj x adj
Adj3=adj2xadj
Adj4=adj2xadj

Path matrix = adj or adr2 or adj3 or adj4

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