IT4105: IT Programming II

Part 2 - Structured Question Paper
29ᵗʰ September, 2018
(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 **10 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	
To be completed by the examiners:			

1)

a) | Data[] is an array that is declared as int Data[20] and contains the following values:

Data[] = {12, 23, 34, 45, 56, 67, 78, 89, 90, 100};

Show the memory representation of the Array with their indexes and contents.

(4 Marks)

ANSWER IN THIS BOX

12	23	34	45	56	67	78	89	90	100
Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]	Data[8]	Data[9]

b) | Write a pseudo code algorithm or Java program segment to insert an element in the middle of the array, based on the following.

The algorithm/program INSERT will be declared as INSERT (A, N, POS, VAL). The arguments are:
(i) A, the array in which the element has to be inserted
(ii) N, the number of elements in the array
(iii) POS, the position at which the element has to be inserted
(iv) VAL, the value that has to be inserted

(6 Marks)

ANSWER IN THIS BOX

Step 1: [INITIALIZATION] SET I = N
Step 2: Repeat Steps 3 and 4 while I >= POS
Step 3: SET A[I + 1] = A[I]
Step 4: SET I = I – 1
[END OF LOOP]
Step 5: SET N = N + 1
Step 6: SET A[POS] = VAL
Step 7: EXIT

c) Write a pseudo code algorithm or Java program segment to print all the elements in the data array given in part (a) above.

(4 Marks)

ANSWER IN THIS BOX

Step 1: [INITIALIZATION] SET I = lower_bound
Step 2: Repeat Steps 3 to 4 while I <= upper_bound
Step 3: Apply Process to A[I] #or print
Step 4: SET I = I + 1
[END OF LOOP]
Step 5: EXIT
Or equivalent

d) Consider the following Doubly Linked List.
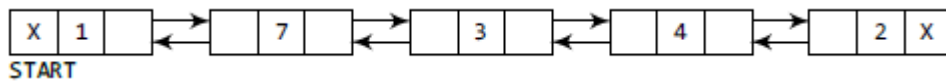
START

Note: START is the initial reference of the doubly linked list and NEW_NODE is the initial reference of the new node which has to be inserted.
The Class structure of the doubly linked list can be defined as follows:

Class ListNode
    {
            Object ELEMENT;
            ListNode NEXT;
            Listnode PREV;
    }

Write a pseudo code algorithm/Java program segment to insert a new node (its element part set to 9 and PREV field set to NULL) as the first node in the above linked list.

Hint: After the insertion, the resultant list should be obtained as follows:
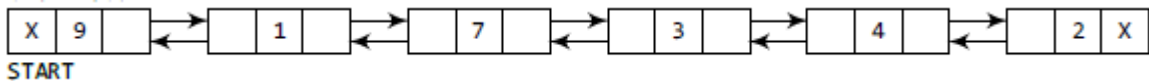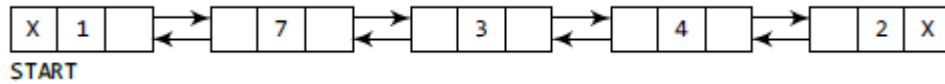

START

(5 Marks)

ANSWER IN THIS BOX

Step 1: SET NEW_NODE->ELEMENT = VAL OR 9
STEP 2: SET NEW_NODE->PREV=NULL
STEP 3: SET NEW_NODE->NEXT =START
STEP 4: SET START->PREV=NEW_NODE
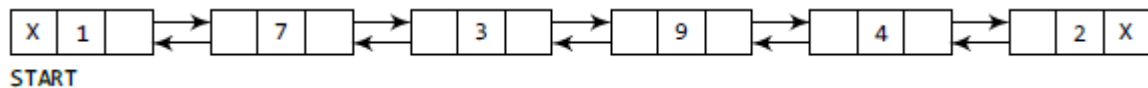STEP 5: SET START=NEW_NODE
STEP 6: EXIT

e) Write a pseudo code algorithm/Java program segment to add a new node with element value 9 after the node containing element 3.

For your convenience, the initial list and the resultant list are given below:

Initial List

START

Resultant List :

START

(6 Marks)

ANSWER IN THIS BOX

STEP 1:SET NEW_NODE->ELEMENET=9 0R VAL

STEP 2: SET PTR=START

STEP 3: Repeat STEP 4 WHILE PTR->ELEMENT!=VAL OR 9

STEP 4: SET PTR=PTR->NEXT

    [END OF LOOP]

STEP 5: SET NEW_NODE->NEXT=PTR

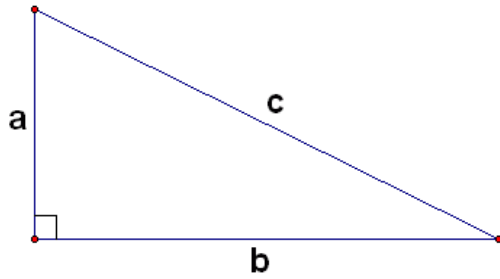STEP 6: SET NEW-NODE->PREV=PTR->PREV

STEP 7 :PTR->PREV=NEW-NODE

STEP 9: PTR->PREV->NEXT =NEW-NODE

STEP 10:EXIT

OR EQUIVELENT

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2) (a)

Consider the following diagram.

$$a^2 + b^2 = c^2$$

Pythagorean Triples consists of three positive integers a, b, and c, such that: $a^2 + b^2 = c^2$
An example of a Pythagorean Triplet is 3, 4 and 5 because $3^2 + 4^2 = 5^2$, since $9 + 16 = 25$. But
5, 6 and 7 is not a Pythagorean Triplet because $5^2 + 6^2 \neq 7^2$ or $25 + 36$ is not equal to 49.

Write a pseudo code algorithm or Java code program segment to generate the Pythagorean
Triplets as follows:
If max=10 (the max value to be input from the keyboard), then following Pythagorean Triplets
to be generated from your program)
3, 4, 5
6, 8, 10

(4 Marks)

ANSWER IN THIS BOX

Read Max number as n
for a=1 to n   # both 1 and n both inclusive)

for b=a to n

c_square=a**2+b**2 # square values of a and b)

c=int(sqrt(c_square)) #(take the square root value(integer part) using any method)
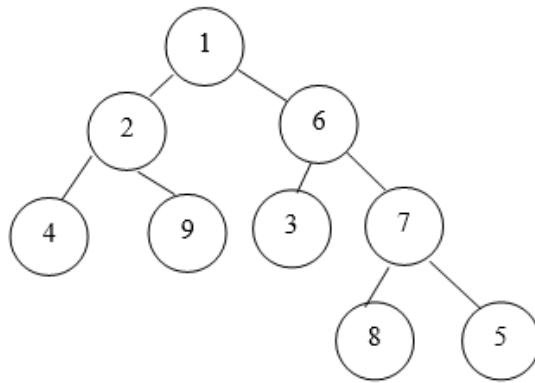
If (c_square-c**2)==0)
print(a,b,c)
endif
next b
next a

Note # - denote a comment
Or equivalent code

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b) | Consider the following binary tree.

Write the order of the nodes traversed, if one visits the nodes of the above tree using (i) pre-order (ii) in-order and (iii) post-order traversals.

(6 Marks)

ANSWER IN THIS BOX

(i) 1,2,4,9,6,3,7,8,5

(ii) 4,2,9,1,3,6,8,7,5

(iii)4,9,2,3,8,5,7,6,1

c)

One creates a Binary Search Tree with the data set given below and subsequently a node is deleted from the tree. If this node could be either 04, 07, 22, or 15, determine the suitable nodes(s) from the remaining nodes to replace the deleted node. You may assume that every deletion is independent and would be performed on the original tree.

Data set: 15,22,07,29,27,31,19,04
Nodes to be deleted are:

(i)   04

(ii)   07

(iii)   22

(iv)   15

(4 Marks)

ANSWER IN THIS BOX

Delated Node	Replacing Node(s)
4	No. (No replacing node, deleted node is a leaf node
7	4
22	19 or 27
15	7 or 19

d) You have been given instructions to create an AVL tree using the following set of integer values.

5,12,17,2,04,06

During the AVL construction process, imbalance situations may occur. Fill in the table below for columns 2 and 3 of such imbalance scenarios.

(6 Marks)

ANSWER IN THIS BOX

Newly inserted Node	Node at which the imbalance occurred	Name the rotation required to restore the balance
5		
12		
17	5	Single rotation
02		
04	5	Double rotation
06		Double rotation

(e)   Write an iterative Java program segment or Pseudo Code Algorithm to find the minimum key value form a Binary Search Tree.

(5 Marks)

ANSWER IN THIS BOX

```
private BinaryNode findMax(BinaryNode t)
{
if (t!=null)
While (t.lef!=null)
t=t.left;
return t;
}
```

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