CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Information Technology

FINAL EXAMINATION
JANUARY 2016 SESSION

SUBJECT CODE	:	ITD20603
SUBJECT TITLE	:	DATA STRUCTURE
LEVEL	:	DIPLOMA
TIME / DURATION	:	9.00 am – 11.30 am (2 ½ HOURS)
DATE	:	20 MAY 2016

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.

2. This question paper has information printed on both sides of the paper.

3. This question paper consists of two sections; Section A and Section B.

4. Answer ALL questions in Section A. For Section B, answer THREE(3) questions only. Question 1 and 2 are COMPULSORY.

5. Please write your answers on the answer booklet provided.

THERE ARE 12 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 25 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

1. When you add an item to a stack, you place it
   A. on the bottom
   B. in the middle
   C. on the top
   D. it does not matter where

2. When you remove an item from a stack, you remove it from
   A. the bottom
   B. the top
   C. the middle
   D. wherever the user specifies

3. Which of the following is valid when attempting to remove an item from an empty stack?
   A. a precondition that the stack is not empty has been met
   B. throw an exception
   C. return null
   D. all of the above

4. Selecting the smallest element of an array and swapping it with the smallest entry, is applying which sorting method?
   A. insertion sort
   B. shell sort
   C. selection sort
   D. all of the above

5. Which sorting method divides an array into halves, sorts them and merges them back into one sorted array?

    A.   insertion sort

    B.   merge sort

    C.   bubble sort

    D.   selection sort

6. Where does a queue add new items?

    A.   at the back

    B.   in the middle

    C.   randomly

    D.   at the front

7. You can add a new entry in a linked list

    A.   at the beginning

    B.   at the end

    C.   in between existing entries

    D.   all of the above

8. If a linked list is empty, the head reference is

    A.   an empty node with the data field not set

    B.   null

    C.   in an illegal state

    D.   none of the above

9. In a binary search tree, data in a node's _____ subtree are more than the data in a node's _____ subtree.

    A.   right, left

    B.   left, middle

    C.   left, right

    D.   middle, right

10.   In a _____ traversal of a binary search tree, you visit the root node before you visit the
       root's subtrees.
       A.   postorder
       B.   preorder
       C.   inorder
       D.   level order

11.   In the implementation of a linked list, the add method
       public void add(int newPosition, T newEntry), inserts a new entry..
       A.   between adjacent nodes of the list
       B.   at the end of the list
       C.   at the beginning of the list
       D.   all of the above

12.   Stacks can be implemented using array and linked list.
       A.   True
       B.   False

13.   You must know how much memory to allocate before creating a linked list
       implementation.
       A.   True
       B.   False

14.   Which of the following is the precondition for binary search algorithm?
       A.   The middle element of the array could be directly accessed
       B.   The data in the array must be sorted
       C.   The first and the last item will not be the searched item.
       D.   None of the above

15.   An array of 100 items is sorted in ascending order. Assume that you are searching for
        the value 165. In the same array, the entry at array index [50] has a value 72.
        What can we conclude from the given description?
        A.   the value 165 will not be found at indexes [0] through [50]
        B.   if the value 165 is in the array, it will be found somewhere at indexes [51]
                through [99]
        C.   one half of the array can be ignored in the next step of searching
        D.   all of the above

16.   One main limitation of a linear queue is that, the
        A.   empty memory spaces are not reusable to store new data
        B.   add operation could only be done after delete operation
        C.   delete operation could only be done after add operation
        D.   empty and full queue methods are not working efficiently

17.   Linked lists are best suited for
        A.   permanent collections of data
        B.   the size of the list which is constantly changing
        C.   A & B
        D.   none of the above

18.   The operation to retrieve the top entry of a stack without removing it is called as,
        A.   look
        B.   pop
        C.   peek
        D.   top

19.   To convert an infix expression to a postfix expression,
        A.   scan the infix expression left to right
        B.   scan the infix expression right to left
        C.   search for all of the operators first
        D.   search for all of the operands first

20.   What is the entry returned by the *peek* method after the following stack operations?

push(A), push(R), pop(), push(D),   pop(), push(L), pop(), push(J), push(S), pop(),

pop().

    A.   L

    B.   S

    C.   A

    D.   J

21.   Which of the following is not the required condition for binary search?

    A.   The array must be sorted

    B.   The middle element could be directly accessed in any subarray

    C.   The item to be searched must not be the first or the last item in the array

    D.   None of the above

22.   The best case of binary search is when ____

    A.   item to be searched is not in the array

    B.   item to be searched is in the middle of the array

    C.   item to be searched is the first/last element in the array

    D.   item is the first/last element in the array or item is not there at all.

23.   Consider the following binary tree:
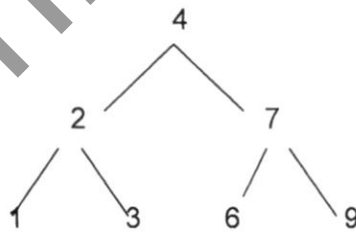
    A.   This tree's height is 7

    B.   This is a binary search tree

    C.   Node 4 is a leaf node

    D.   A new node with value 8, will be added to the left of node 1

24.   If the front reference and back reference of a queue points to one same value, what is
       the size of the queue?

       A.   -1

       B.   2

       C.   0

       D.   1

25.   Stack and queue can be implemented using

       A.   Array

       B.   Linked List

       C.   A & B

       D.   None of the above

SECTION B (Total: 75 marks)

INSTRUCTION: Answer any THREE questions only. Question 1 and 2 are COMPULSORY. Please use the answer booklet provided.

Question 1

a.   Show the content of *s* and *q* for each of the following operations. Also, label the related variables with the correct values for each of the operation execution.

   s.createStack(4);
   s.push(2);
   s.pop(x);
   q.createQueue(3);
   q.enqueue(x);
   q.enqueue(8);
   q.dequeue(y);

                                                                   (10 marks)

b.   Convert the following infix expressions to its postfix form. Use the stack structure in the conversion process.

   i. $(k + (m - p)) / g * b$
   ii. $3 * 5 / 2 - 6 + 7$

                                                                   (6 marks)

c.   Briefly explain the push and pop operations involved to evaluate the postfix expression below. Use the stack diagram to aid the explanation.

        $2 \ 3 + 5 - 3 \ 6 * +$

                                                                   (4 marks)

d.   Palindrome string is a word that reads the same backward as forward.

Using the stack and queue basic operations, list the steps taken (1 to 3, with a conclusion) to determine whether or not an input string is palindrome based on Figure 1 below.
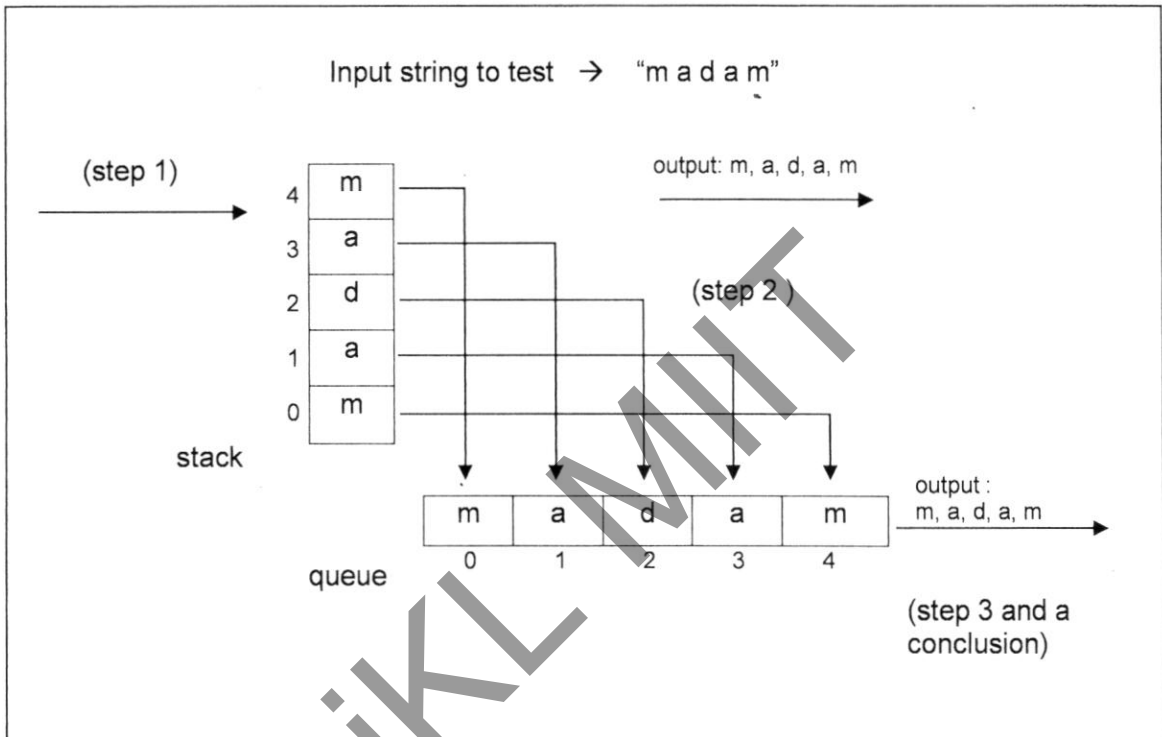

Figure 1: Basic stack and queue operations to determine palindrome string

(5 marks)

Question 2

a.   State **TWO** types of linked list.

(2 marks)

b.   Describe **ONE** major difference between a linked list and an array.

(4 marks)

c.   The following questions are based on Figure 2 below. X is pointing to the head node and Y is pointing to the last node in the list. (All questions are related)
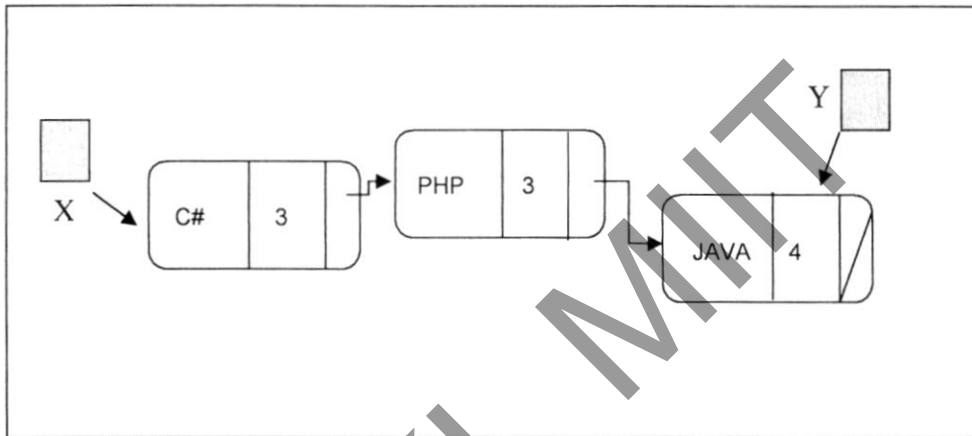

Figure 2: A linked list that stores course titles and credit hours

i.   Define the node used in Figure 2 above. Assume that the node type is *Course*.

(5 marks)

ii.   Declare the pointers (object references) X and Y.

(2 marks)

iii.   Write a java statement to delete the second node.

(3 marks)

iv.   Write a java statement to create a new node pointed by Z.

(2 marks)

v.   Write java statements to store values - "DS" , 4 , and a null into the new node pointed by Z.

(3 marks)

vi.   Write java statement to insert the node pointed by Z at the end of the list and update the necessary pointer.

(4 marks)

Question 3

a. Define the *binary tree*.

(3 marks)

b. Briefly explain the difference between traversing and searching operation in binary tree.

(4 marks)

c. Insert the following strings into an initially empty binary search tree.

brown   white   blue   red   purple   green   grey   black

(4 marks)

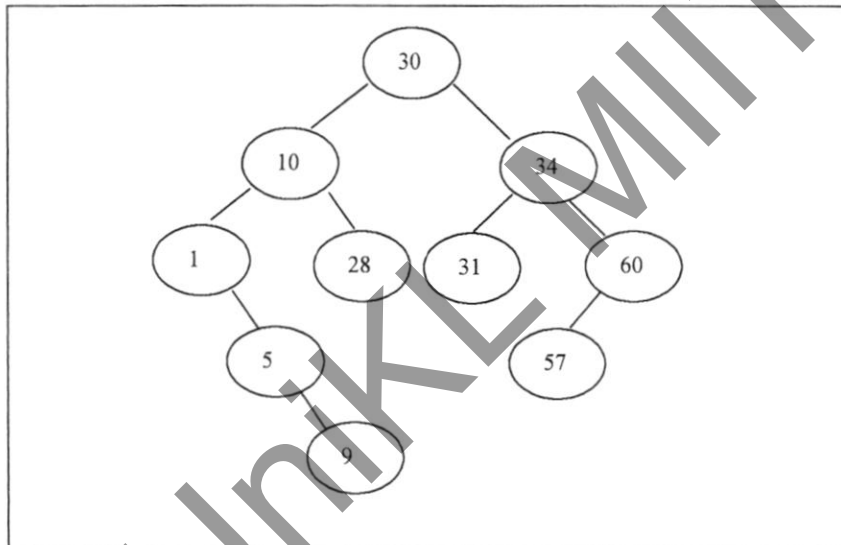d. Answer the following questions based on the tree in Figure 3 below.

Figure 3: A binary search tree

i.   List all the *leaves* in the tree.

(2 marks)

ii. Write the sequence of visited nodes if postorder traversal is used.

(4 marks)

iii. Redraw the tree to show the deletion process of node 28 and 34.

(4 marks)

iv. Briefly explain why delete node operation is harder than other operations.

(4 marks)

Question 4

a.   Show the step by step process to sort the following array elements
      using insertion sort.

      9   5   4   1   6

(5 marks)

b.   Describe **ONE** feature of insertion sort from the resulting sorting process
      you have performed in 4(a) above.

(3 marks)

c.   Briefly explain why linear search is best performed on the sorted array.
      Give an example to support your explanation.

(5 marks)
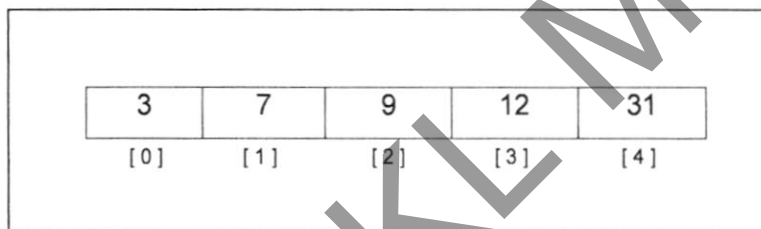
d.   The following questions are based on Figure 4 below:

3	7	9	12	31
[0]	[1]	[2]	[3]	[4]

Figure 4: A sorted array

i.   Show the step by step process to search for value 3 using binary search
      technique.

(8 marks)

ii.   State the number of comparisons made to search for value 3 in 4d(i) above.

(2 marks)

iii. State the number of comparisons made to search for value 3 if linear search
      is used instead.

(2 marks)

END OF QUESTION