INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**APRIL 2019**
Programme	:	Diploma In Information And Communication Technology (DICTN) Diploma In Information Technology (DITN)
Course	:	**ICT2102: Introduction To Data Structure**
Date of Examination	:	28 July 2019, (Sunday)
Time	:	8:00am – 10:am Reading Time : Nil
Duration	:	2 Hours

Special Instructions :

Answer any **FOUR (4)** questions.

Materials permitted :
Non-programmable calculator

Materials provided :
Nil

Examiner(s)	:	**Koo Lee Chun** and Siti Hajar
Moderator	:	Siti Hawa Mohamed Said

*This paper consists of **6** printed pages, including the cover page*

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
DIPLOMA IN INFORMATION TECHNOLOGY (DITN)
ICT2102: INTRODUCTION TO DATA STRUCTURE
FINAL EXAMINATION: APRIL 2019 SESSION

Instruction: This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Define Abstract Data Type

(3 marks)

(b) Explain **THREE (3)** reasons why all data types are abstract.

(3 marks)

(c) Assume that you are given an ADT that stores the subjects offered in a semester. Identify **SIX (6)** operations that can be performed on the ADT.

(6 marks)

(d) Write an ADT class named Car with a constructor that initialize two private attributes: size of the engine (integer) and regular price (float). Besides that the class also provide a method that calculates the current discounted sale price based on the size of the engine as shown below:

- 1000cc and below : 5% discount from the regular price
- 1500cc and below : 10% discount from the regular price
- 2000cc and below : 20% discount from the regular price
- Above 2000cc: 30% discount from the regular price

(13 marks)

Question 2

(a) Briefly explain **TWO (2)** distinct advantages of List implementation using linked list compared to Array.

(4 marks)

(b) A linked list is required to store the inventory of stationery in a shop. The shop needs to record the stationery's information: item name and stock quantity.

(i) Declare a linked list class `StationeryClass` with the following:

- A private member, `StationeryNode`, is a structure of stationary stock record and a pointer to the next `StationeryNode`.
- 2 private pointer variables, `headptr` and `tailptr`, are pointers of `StationeryNode` whereby `headptr` will always point to the first node of the linked-list, and `tailptr` will always refer to the last node of the linked-list
- A private integer member, `noOfItem`, is a counter variable of the number of nodes in a linked-list
- A default constructor
- A public method `addNodeToHead` that inserts a new record of stationery's information to the beginning of the linked list.

(7 marks)

(ii) Define the associate operation `addNodeToHead()`.

(7 marks)

(iii) Use diagrams to represent the linked list after executing the following instruction : [Note: Make sure to show all the data and pointers in the diagram]

```
StationeryClass StockSC;
StockSC.addNodeToHead("ruler",300);
StockSC.addNodeToHead("eraser",500);
StockSC.addNodeToHead("pencil",200);
```

(7 marks)

Question 3

(a) Discuss the differences between ADT Stack and Queue.

(4 marks)

(b) Assume the following private members are declared in a linked-list ADT Stack:

```
struct StackNode
  {
    double item;
    StackNode *next;
  };
 StackNode *topPtr;
```

Write the C++ implementation of the following methods store real numbers:

(i) method pop( ) that remove an item from the Stack.

```
bool Stack::pop (double &data)
```

(5 marks)

(ii) method displayStack( ) that display the content of the Stack from top of the stack to the bottom.

```
void Stack::displayStack ()
```

(5 marks)

(c) Postfix calculation is one of the example of Stack application.

(i) Convert 5-(7+4*2-3) into a postfix expression

(2 marks)

(ii) Show the complete working steps (including stack contents) to evaluate the postfix expression (answer from (c)(i)) in a stack.

(9 marks)

Question 4:

(a) Explain **THREE (3)** scenario of queue operation in a real world scenario. Your explanation must include the concept of insertion and deletion.

(6 marks)

(b) What is the result after executing the following sequence of events in an empty queue : enqueue(50), enqueue(10), dequeue(), enqueue(30), dequeue(),enqueue(40), enqueuer(10)

Present the diagram in the following data structrure:

(i) Array based Queue

(3 marks)

(ii) Linked list based Queue

(3 marks)

(c) Describe in words (no coding is required) how you could implement a queue's enqueue and dequeue operations using two stacks.

(8 marks)

(d) A simple array based implementation of the queue suffers from false overflow. Discuss with example the false overflow issue and solution.

(5 marks)

Question 5:

(a) Discuss **TWO (2)** factors that can influent the efficiency of sorting algorithm.

(4 marks)

(b) Show the steps to sort (in ascending order) for a list of numbers 7,3,5,8,9,1,0 using the following:

(i) Insertion Sort

(7 marks)

(ii) Bubble Sort (first pass only)

(7 marks)

(c) Circular linked-list is a variation of the linked list.

(i) Illustrate a Circular Linked-list (with 3 nodes) in a diagram

(3 marks)

(ii) Write a C++ code fragment to display the last node of a Circular Linked-list. Assume the list is non-empty and head is pointer of the first node.

(4 marks)

Question 6:

(a) Show how binary search tree works when searching for 24 in the following sorted array:

5	8	9	20	24	33	34	35	48	59	62	68	69

(6 marks)

(b) Show a Binary Search Tree (BST) that result from the following sequence of insertions:

5, 10,8,3,2,9,16,30

(4 marks)

(c) Based on the binary tree constructed in Question 6 (b) answer, list the result after traverse the tree using preoder, inorder and post order respectively.

(12 marks)

(d) Show the effect of removing 10, follow by 8 from the BST constructed in Question 6 (b).

(3 marks)

~ The End ~

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