INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**AUGUST 2018**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**ICT2102: Introduction To Data Structure**
Date of Examination	:	8 December 2018, (Saturday)
Time	:	5:00pm – 7:00pm Reading Time : Nil
Duration	:	2 Hours

Special Instructions :

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

Materials permitted :

Non-programmable calculator

Materials provided :

Nil

Examiner(s)	:	**Teng Wei Jian** and Siti Hajar
Moderator	:	Siti Hawa Mohamed Said

This paper consists of 7 printed pages, including the cover page

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
ICT2102: INTRODUCTION TO DATA STRUCTURE
FINAL EXAMINATION: AUGUST 2018 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) Highlight **THREE (3)** differences between Linked Lists and Array based Lists.

(6 marks)

(b) Write C++ statements to perform the following operations:

(i) Dynamically allocate an integer array called `myArray` with 50 elements.

(ii) Deallocate the entire array `myArray`

(4 marks)

(c) Determine the output of the following program:

(i)

```
int *ptr, a=5;
ptr = &a;
*ptr += 1;
cout<<*ptr<<", "<<a<<endl;
```

(2 marks)

(ii)

```
int x = 5;
int *ptr1;
int **ptr2;
ptr1 = &x;
ptr2 = &ptr1;
cout<<x<<", "<<**ptr2<<endl;
```

(2 marks)

(iii)

```
int *arr = new int [5];
for ( int i = 0 ; i < 5; i++ , arr++ )
     *arr = i*2;
for ( int j = 0 ; j < 5; j++ , arr++ )
     cout<<*arr<<" ";
```

(2 marks)

(d) Describe **THREE (3)** advantages of using Abstract Data Types (ADT).

(6 marks)

(e) Give **TWO (2)** example of real world scenarios where the concept of Abstraction can be observed.

(3 marks)

Question 2

(a) Assume that you are given an ADT that stores a collection of subjects offered in a semester.

(i) Identify **FIVE (5)** operations that can be performed on such an ADT.

(5 marks)

(ii) Provide **THREE (3)** types of suitable data structure to store the data in the ADT.

(3 marks)

(iii) From your answers given in Q2(a)(ii), recommend and justify ONE suitable data structure by highlighting a characteristic of that data structure and why it is suitable for this application

(2 marks)

(b) There are many ways in which a linked list can be implemented. Draw a diagram to illustrate each of the following types of linked lists: (include at least 4 items in the list)

(i) Circular Linked List

(3 marks)

(ii) Doubly Linked List

(3 marks)

(c) Consider the following sequence of operations of stack:

```
push("ICT1101")
push("ICT1103")
push("ICT2102")
pop()
push("ICT2107B")
push("INT2100")
pop()
pop()
push("ICT2100")
```

Use a diagram to illustrate the state of the stack after each of the nine operations.

(9 marks)

Question 3

(a) Consider the following sequence of actions:

```
insert(5)
insert(7)
remove()
insert(1)
insert(4)
remove()
remove()
insert(3)
```

Demonstrate, step by step, how these actions will change a Queue by drawing the state of the data structure for each step.

(8 marks)

(b) Give **ONE** real world example of where a Stack and a Queue can be observed. (one example each)

(4 marks)

(c) Assuming an ADT for a Queue is implemented using Linked List. List and describe all the private member variables that are necessary to make the implementation work. Assuming that the node contains an integer data.

(6 marks)

(d) Explain what is false overflow in a simple array based implementation of the queue.

(4 marks)

(e) Explain how the issue of a false overflow in a simple array based implementation of the queue can be resolved.

(3 marks)

Question 4

(a) Provide the class definition (declaration) of a Stack implemented using linked list, showing the data structure involved as well as the class interfaces.

* Note:

- you must include all the basic operations of a Stack in the definition, but you do not have to provide the details of the implementation.
- Assume that the data item is an integer value

(7 marks)

(b) Describe in either your own words or in pseudocode how the **TWO (2)** basic Stack operations will be implemented if the Stack is implemented using a linked list.

(8 marks)

(c) Convert the following infix notation expressions into their equivalent postfix notation expression:

(i) $A * (B - C)/D$

(2 marks)

(ii) $(A + B) * C + D/(B + C)$

(3 marks)

(d) Show the working steps (including the stack contents) of how the following postfix notation expression is evaluated.

$$5\ 2\ 8\ *\ +\ 3\ -$$

(5 marks)

Question 5

(a) Define sorting in data structure.

(2 marks)

(b) Bubble Sort compares all the element one by one and sort them based on their values. Consider an unsorted array = {7, 4, 5, 2}. Trace the array step by step to sort it by using Bubble Sort algorithm. Show your steps by drawing an array. Show the sorting movement by circling the index or using arrows.

(7 marks)

(c) Explain the differences between Insertion sort and Selection sort.

(4 marks)

(d) Define Quick Sort and its algorithm.

(3 marks)

(e) Based on the initial array: 4, 2, 6, 5, 3, 9, trace the array by using Quick Sort to show how the algorithm works. Show your steps by drawing the array and circle or use arrow to point your current sorting position.

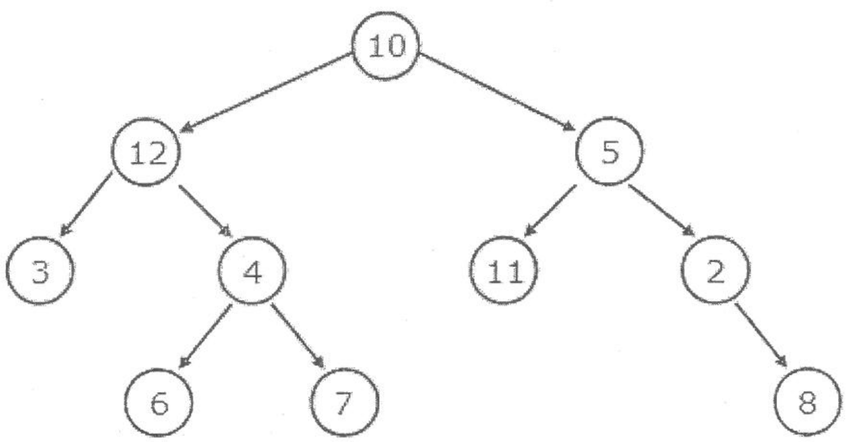
(9 marks)

Question 6

(a) A tree data structure can be defined recursively as a collection of nodes where each node is a data structure consisting of a value. Illustrate a tree structure which include:
   (i) Path
   (ii) Root node
   (iii) Parent node
   (iv) Child node
   (v) Leaf note

(5 marks)

(b) In a binary tree, traversal is a process to visit all the nodes of a tree and may print their values too. Traverse the binary tree below using these methods:



(i) In-Order Traversal

(5 marks)

(ii) Pre-Order Traversal

(5 marks)

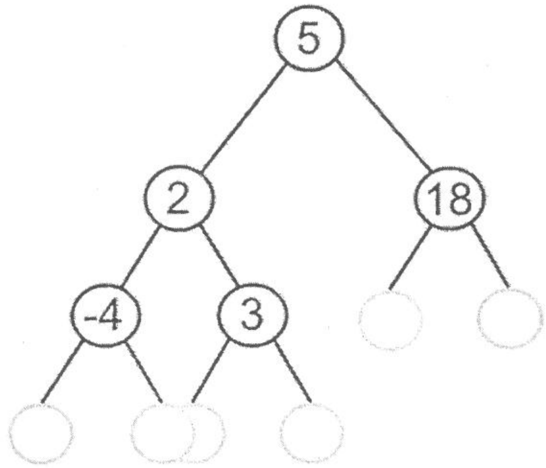
(iii) Post-Order Traversal

(5 marks)

(c) Adding a value to Binary Search Tree (BST) can be divided into two stages:

(i) search for a place to put a new element
(ii) insert the new element to this place.

By using the stages, insert number 4 to the tree show below:



(5 marks)

~ **End** ~

ict2102(final)/august2018/formatted