INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**AUGUST 2017**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**ICT2102: Introduction To Data Structure**
Date of Examination	:	14 December, 2017 (Thursday)
Time	:	2:00 pm – 4:00 pm Reading Time : Nil
Duration	:	2 Hours

Special Instructions :

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

Materials permitted : Non-programmable calculator

Materials provided : Nil

Examiner(s) : **Siti Hajar** and Koo Lee Chun

Moderator : Siti Hawa Mohamed Said

*This paper consists of **8** printed pages, including the cover page*

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY
PROGRAMME (DICTN)
ICT2102: INTRODUCTION TO DATA STRUCTURE
FINAL EXAMINATION: AUGUST 2017 SESSION

Instruction: Answer any **FOUR (4)** questions in the answer booklet provided.

Question 1

(a) In your own words, provide **THREE (3)** descriptions of Data Structure. (6 marks)

(b) Explain **THREE (3)** scenarios that need the application of Data Structure for its efficiency. (9 marks)

(c) Datatype is a special keyword used to allocate sufficient memory space for the data. List **THREE (3)** mostly used data types in C++ or JAVA. (3 marks)

(d) In pointer objects, each variable you create in your program is assigned a location in the computer's memory. The value the variable stores is actually stored in the location assigned. Based on the program below, trace the variable representing:

(i) Data value
(ii) Address of data value
(iii) Pointer that holds the address of the data value
(iv) Content of address Pointer

```
#include <iostream>
using namespace std;
int main() {
    int *pc, c;

    c = 5;
    cout << &c << endl;
    cout << c << endl << endl;

    pc = &c;
    cout << *pc << endl << endl;
    cout << pc << endl;

return 0;
}
```

(4 marks)

(e) Structures are used to represent a record. Create a structure called `Students` which has **TWO (2)** records called `studentName` and `studentID`. Both records respectively use `char` and `int` as datatypes.

(3 marks)

Question 2

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

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

(5 marks)

(ii) Provide **FIVE (5)** types of data structure to store the data in the list.

(5 marks)

(b) Transform the following infix expression into postfix expression:

(i) a+(b+c)*d

(3 marks)

(ii) 4 + 6 /2 * 5 – 3

(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) Assume an ADT Stack which consists of the following attributes:

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

Write the C++ implementation of the following methods in the ADT Stack:

(i) Method `push( )` that pushes an item into the stack. Use below method header:

```
bool Stack::push (double newItem)
```

(5 marks)

(ii) Method `displayStack( )` that displays the stack content from top to bottom. Use below method header :

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

(6 marks)

(b) Assume `s1` is a stack consists of 1 ,4, 2, 8, 9 where 9 is at the top of the stack. Write a program code segment to reverse `s1` stack's content. For example, after reversing, the stack shall contains 9, 8, 2, 4, 1 where 1 is the top of the stack. You program shall display appropriate message to handle empty stack. You are limited to use the operation provided in ADT Stack : `push()`, `pop()`, `isEmpty()`, `getSize();`

(5 marks)

(c) Show complete working steps (including stack contents) to evaluate below postfix expression result.

4	3	6	3	*	12	-	*	+	=

(9 marks)

Question 4

(a) The banking queue system facilitates the queuing process to customers who are waiting for their turn to be served. Consider the following structure:

```
struct  BankQueueNode { // declaration of QueueNode
int number;
BankQueueNode *next;
};
```

Write a function member `dequeueNumber ()` that removes the number in the queue when the counter is free to serve the bank customer.

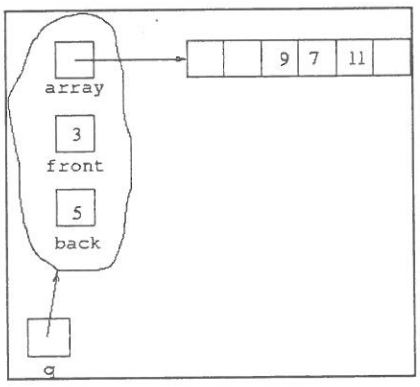
(8 marks)

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

(6 marks)

(c) The diagram below shows the representation of queue (q) 9,7 and 11. Suppose the length of the array is 6. Discuss what happens if a method `q.join(12)` is executed. Your discussion should include:

(i) Which number is at the front index
(ii) Which number is at the last index
(iii) Where number 12 will be joined
(iv) What is the latest index number for node `front` and node `back` after `q.join` is executed.



(6 marks)

(d) Briefly explain double-ended queue or deque. Assist your explanation with a drawing of an array that shows the location to perform insertion and deletion.

(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)

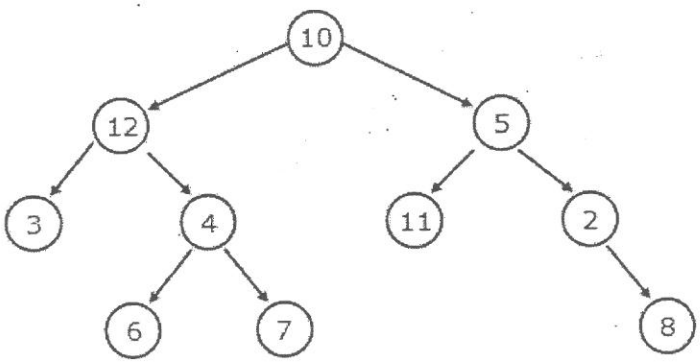
Question 6

(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)

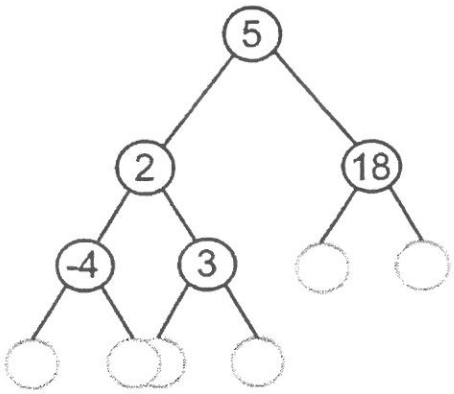
(iii) Post-Order Traversal

(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:



(5 marks)

~ The End ~