INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**AUGUST 2019**
Programme	:	Diploma In Information And Communication Technology (DICTN) Diploma In Information Technology (DITN)
Course	:	**ICT2102: Introduction To Data Structure**
Date of Examination	:	December 9, 2019 (Monday)
Time	:	2:00pm – 4:00pm 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 Lusiana
Moderator	:	Siti Hawa Mohamed Said

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

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
DIPLOMA IN INFORMATION TECHNOLOGY PROGRAMME (DITN)
ICT2102: INTRODUCTION TO DATA STRUCTURE
FINAL EXAMINATION: AUGUST 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) By using 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) Explain THREE (3) reasons why C++ classes are perfect for Abstract Data Type (ADT)
(6 marks)

(d) 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. Consider the following program. Identify:
(i) The variable containing the data value
(ii) A code to retrieve the address of a variable
(iii) A pointer variable that holds the address of the variable containing the data value
(iv) A code to retrieve the data value using a 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)

(Total: 25 marks)

Question 2

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

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

(5 marks)

(ii) Provide **THREE (3)** possible ways to implement the list ADT above.

(3 marks)

(iii) From your answers given in Q2(a)(ii), recommend and justify the most suitable data structure that can be used to implement the list ADT by highlighting a characteristic of that data structure and why it is suitable.

(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")
```

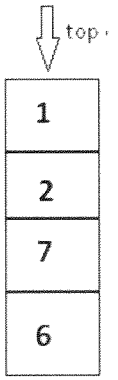
Use a diagram to illustrate the state of the stack after each of the nine operations.

(9 marks)

(Total: 25 marks)

Question 3

(a) With the aid of a diagram, explain the operations of push(), pop() and peek(). You may refer to the stack shown below.



(12 marks)

(b) What is the output of the following program segment?

```
linkedStackType<int> myStack;

myStack.push(10);
myStack.push(20);
myStack.pop();
cout<<myStack.top()<<endl;
myStack.push(25);
myStack.push(2*myStack.top());
myStack.push(-10);
myStack.pop();

linkedStackType<int>tempStack;
tempStack=myStack;

while(!tempStack.isEmptyStack())
{
cout<<tempStack.top()<< " ";
tempStack.pop();
}
cout<<endl;
cout<<myStack.top()<<endl;
```

(4 marks)

(c) Convert the following infix expressions to postfix and prefix.

i) T $ S / U + (N – A * M + I)

ii) (S + A) – (T - E) * (L * L) – I - T – E

iii) A * (P- (O/ (C + A))) – L + Y / P * S $ E

(9 marks)

(Total: 25 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 output of the following program segment?

```
queue.addQueue(10);
queue.addQueue(20);
cout<<queue.front()<<endl;
queue.deleteQueue();
queue.addQueue(2*queue.back());
queue.addQueue(queue.front());
queue.addQueue(5);
queue.addQueue(queue.back()-2);

linkedQueueType<> tempQueue;
tempQueue=queue;
while(!tempQueue.isEmptyQueue())
{
cout<< tempQueue.front()<< "";
tempQueue.deleteQueue();
}
cout<<endl;
cout<<queue.front()<< ""
<<queue.back()<<endl;
```

(8 marks)

(c) The clinic queue system facilitates the queuing process to patients who are waiting for their turn to be served. Consider the following structure and function:

```
struct ClinicQueueNode
{
   int number;
   ClinicQueueNode *next;
};
bool Queue:: dequeueNumber (int & data)
{
  ...
}
```

Write a function member dequeueNumber () that removes and returns the number in the queue when the counter is free to serve the patients.

(11 marks)

(Total: 25 marks)

Question 5

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

(4 marks)

(b) Given an unsorted array of integers:

23	45	17	37	41	29	33

(i) Outline the algorithm of how Insertion Sort is done.

(4 marks)

(ii) Trace the array by using Insertion Sort to show how the algorithm works. Show your steps and clearly indicate the current sorting position.

(4 marks)

(iii) Trace the array by using Bubble Sort to show how the algorithm works. Show your steps and clearly indicate the current sorting position. (Show only the end result after each pass)

(4 marks)