INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	August 2016
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**ICT2102: Introduction To Data Structure**
Date of Examination	:	08 December, 2016 (Thursday)
Time	:	8:00am – 10:00am 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 Shee Fui Chie
Moderator	:	Siti Hawa Mohamed Said

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

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY
PROGRAMME (DICTN)
ICT2102: INTRODUCTION TO DATA STRUCTURE
FINAL EXAMINATION: AUGUST 2016 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.

(6 marks)

(c) Trace the output of the following code fragment:

(i)
```
int a=5;
int *x  = &a;
int *y;
y = new int;

*x = 10;
*y = 20;
*x = *x + 30;
a = a + 12;
cout << *x << "," << *y << "," << a << endl;
x=y;
x = *x + 10;
a= a+ 20;
cout << *x << " ," <<  *y << "," << a << endl;
```

(3 marks)

(ii)
```
void main() {
        int a[20] = { 1,4,7,10,13,20,29,30,35,40,47,52,58,60,66,70,73,85,89,99 };
        char b[] = "POKEMON GO";
        int i=0;
        int *p = a;
        char *q = b;

        while (i < 5 ){
                cout <<i<<"\t"<< *p <<"\t"<< *(a + i) << "\t"<<q<<endl;
                i++;
                p += 3;
                q += 2;
        }
}
```

(5 marks)

(d) Complete the following buble sort function.
Take note that a [ ] consists of a series of numbers to be sorted, whereas n is number of element in the array.

```
void bubbleSort (int a[], int n){
}
```

(8 marks)

Question 2

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

(4 marks)

(b) Given an ADT LinkedList with private members as below :

```
struct Node {
    int item;
    Node *next;
};
Node *head;
Node *tail;
int numOfItems;
```

Implement the following new functions for the above Linked List :

(i) bool remove (int d)
This method will remove the first occurrence of an item with value given as d and return a status (true – at least 1 item is removed, false – no item is removed).

(10 marks)

(ii) int getTotal ()
This method will return the sum of all the item values in the linked list.

(5 marks)

(c) There are various types of linked list implementation. Draw a diagram to represent each of the following types of linked-lists : (Assume 3 items in the list)

(i) Doubly Linked List

(3 marks)

(ii) Circular Linked List

(3 marks)

Question 3

(a) Discuss the differences between Queue and Stack. Provide example for each to support your answer.

(6 marks)

(b) Show the results of the following sequence of events :
enqueue(10), enqueue(20), enqueue(30), dequeue(),dequeue(),enqueue(40)

Present the data structure using:

(i) Array based Queue

(3 marks)

(ii) Linked list based Queue

(3 marks)

(c) 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)

(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 4

(a) Given the following statements :

```
IntStack s;
s.push(50);
s.push(30);
s.push(60);
cout << s.pop( );
```

(i) Suppose that s is represented by an array. Draw the state of the private instance variables of s after the above code is executed.

(3 marks)

(ii) Suppose that s is represented by a linked list. Draw the state of the private member variables of s after the above code is executed.

(3 marks)

(b) Provide a linked list declaration of a Stack, showing the data structure involved and class interfaces. You can leave out the details implementation of the functions

(7 marks)

(c) Based on answer (b), provide the C++ implementation for **THREE (3)** main Stack operations.

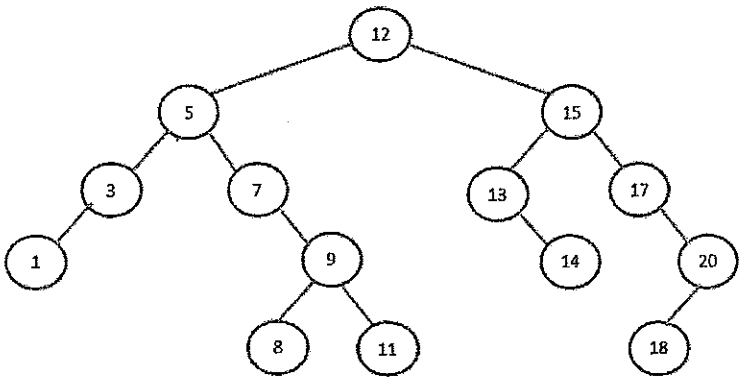
(12 marks)

Question 5

(a) State **TWO (2)** properties of binary search tree.

(2 marks)

(b) Given the following binary search tree :



(i) List the result of post order traversal of the above tree.

(4 marks)

(ii) Show the resultant tree after removing keys 7 and 15 from the tree.

(3 marks)

(c) Complete the following search implementation of binary search tree:

```
bool BST::search (int data) {
  }
```

(8 marks)

(d) Using diagram, show the detailed workings of selection sort in ascending for the following :
34,47,12,80,45,13, 6, 10,2

(8 marks)

Question 6

(a) Show how binary search works when searching for 14 in the following array :

5	8	10	14	26	38	45	58	67	69	74	82

(6 marks)

(b) Discuss **TWO (2)** factors that can influence the efficiency of sorting algorithm.

(4 marks)

(c) Stack can be used in the postfix expression evaluation.

(i) Convert the following expression into postfix
5 * 3 – 7 / 2

(2 marks)

(ii) Show complete working steps (including stack contents) to evaluate the postfix above.

(8 marks)

(d) Besides postfix expression evaluation, discuss **ONE (1)** application of stack and steps involved.

(5 marks)

~ The End ~

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