

**FINAL
ALTERNATIVE ASSESSMENT**

(COVER PAGE)

Session : April 2022

Programme : Diploma In Computer Science (DCS)
Diploma In Information Technology (DITN)

Course : **DCS2101: Data Structure/
ICT2102 Introduction To Data Structure**

Date of Examination : 04 August 2022

Time : 04.00pm-06.30pm Reading Time : Nil

Duration : 02 hours 30 minutes

Note: 30 minutes is added into the duration of the examination to factor in any connectivity matters and for you to scan and upload your script.

Special Instructions :

This paper consists of **FIVE (5)** questions. Answer **ALL** questions in the answer booklet provided.

Material permitted : Non-Programmable Scientific Calculator

Materials provided : Nil

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

Chief Moderator : Yogeswari Suppiah

This paper consists of 4 printed pages, including the cover page

DIPLOMA IN COMPUTER SCIENCE (DCS)
DIPLOMA IN INFORMATION TECHNOLOGY (DITN)
DCS2101: DATA STRUCTURE/
ICT2102 INTRODUCTION TO DATA STRUCTURE
FINAL EXAMINATION: APRIL 2022 SESSION

Instruction: This paper consists of **FIVE (5)** questions. Answer **ALL** questions in the answer booklet provided. All questions carry equal marks.

Question 1

- (a) Define Abstract Data Type (3 marks)
- (b) Discuss **TWO (2)** factors that can influence the efficiency of sorting algorithm. (3 marks)
- (c) Show the steps to sort (in ascending order) for a list of numbers 27,73,35,24,69,51,16 using the following sorting algorithm:
- (i) Bubble Sort (Only 1st pass) (3 marks)
- (ii) Quick Sort (Assume first item is pivot value) (6 marks)
- (d) Draw the diagrams to illustrate the final memory state after executing the following code segment :
Note: show clearly the content in the memory and label all the variables (including pointer variables).
- ```
int *p = new int;
int *q = new int;
int x = 50;
*p= 30;
*q = *p * 2
q= p;
*q = *q +10;
p=&x;
```
- (5 marks)

**Question 2**

- (a) Identify the most suitable data structure for the following applications and briefly explain the implementation ideas :
- (i). A program to keep track of patients as they check into a medical clinic, assigning patients to doctors on a first come first served basis. (3 marks)
  - (ii). A program to show the 5 latest missed calls (3 marks)
- (b) C++ structures are used to represent a node in a linked list design. Define a C++ structure called `TaskNode` that to be used in a linked list design. Each task consists of `taskID(int)`, `description(string)`, `duration(int)`. (3 marks)
- (c) Assume `headPtr`, `tailPtr` are pointers of the `TaskNode`, and `isEmpty()` function is defined in the linked list class.

By using your own words, explain the steps to insert a node in front of a singly linked list. Assist your explanation by define a function in C++ named `addFirstElement` in the `Linked List` class. The function shall accepts `taskID`, `description` and `duration` of a task as parameters and add the task as first element into the linked-list.

(11 marks)

**Question 3**

- (a) Discuss the differences between ADT Stack and Queue. (4 marks)
- (b) What is the result after executing the following sequence of events in an empty stack :  
`push(10)`, `push(80)`, `push(60)`, `pop()`, `push(70)`, `push(30)`, `pop()`

Present the diagram in the following data structure:

- (i) Array based Stack.  
 Note : Label the array index and top variable appropriately (2 marks)
- (ii) Linked list based Stack  
 Note : Label the top pointer appropriately (4 marks)

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

(i) Convert the folloiwng expression to post fix expression :

$$19+(17+15/3-20)$$

(2 marks)

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

(8 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) Write the body for a function that replaces each copy of an item in a queue with another item by using the following specification.

Function header: ReplaceItem (QueType<int> queue, int oldItem, int newItem)

Function: Replaces all occurrence of oldItem with newItem.

Precondition: Queue have been initialized.

Postcondition: each occurrence of oldItem in queue has been replaced with newItem.

(9 marks)

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

50, 18, 20, 19, 34, 12, 5, 76, 39,53

(5 marks)

(b) Based on the binary tree constructed in Question 5 (a), answer the following questions.

(i) How many leaves are there?

(1 mark)

(ii) State the height of node 18

(1 mark)

(iii) List the result of preorder traversal

(5 marks)

(iv) List the result of postorder traversal

(5 marks)

(c) Show the effect of removing 18 from the BST constructed in Question 5 (a).

(3 marks)

**~THE END~**

*ICT2102/DCS2101 (F) April 2022 Session/ formatted*