



SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide In Act No. 29 of 1995)

Higher National Diploma In Information Technology

First Year, Second Semester Examination – 2018

HNDIT 1211: Data Structures and Algorithms

Instructions for Candidates:

Answer any four (04) questions only.

No. of Questions

: 05 Questions

No. of Pages

: 04 Pages

Time

: Two (02) Hours

Question 01

- a) Briefly explain the term “Data Structure” in computer programming. (02 Marks)
- b) Explain the following terms by using suitable examples.
I. Primitive Data type
II. Abstract Data type (04 Marks)
- c) Identify the difference between Linear Data Structures and Non-Linear Data Structures. Give suitable examples for each type. (04 Marks)
- d) Fill in the blanks by using suitable words given in the brackets. (05 Marks)
- I. efficiency explains the minimum number of steps that an algorithm can take with any collection of data values. (Best Case, Worst Case, Average Case)
- II. If the number of operations in an algorithm is $n^3 + 2n + 10$, the big O' notation of this algorithm is ($O(1)$, $O(n)$, $O(n^2)$, $O(n^3)$)
- III. is an example for non-linear data structure. (Array, Linked List, Graph)
- IV. Generally $O(n^2)$ is faster than ($O(n)$, $O(n^3)$)
- V. has last-in-first-out behavior. (Stack, Array, Queue, Tree)
- e) Write suitable C++ codes to the followings.
- I. Create the following array with the name “first” using a single statement.
- | | | | | |
|---|----|----|---|----|
| 3 | 20 | 10 | 7 | 11 |
|---|----|----|---|----|
- (02 Marks)
- II. Declare an integer array with the name “second”, with the size 5 and without assigning any value. (01 Mark)
- III. Write a C++ code segment to assign values taken as keyboard inputs to the “second” array using a ‘for’ loop. (02 Marks)
- IV. Write a C++ code to compare the two arrays “first” and “second”.
Note: If two arrays are similar, you need to display “Arrays are matching” and if not, you need to display “Arrays are not matching” (05 Marks)

Question 02

a) What is Linked List?

(02 Marks)

b) State an advantage of Linked List over Arrays

(02 Marks)

c) Graphically illustrate the following stack operations sequentially.

(03 Marks)

- I. initializeStack()
- II. push (10)
- III. a = pop ()
- IV. y = isEmpty()
- V. push (7)
- VI. x = topElement()

d) Graphically illustrate the static (array based) implementation for the following stack operations.

Note: Size of the array is 3

(06 Marks)

- I. initializeStack ()
- II. push (100)
- III. push (50)
- IV. a= pop ()
- V. push (70); push (80)
- VI. b = isFull()

e) Consider following stack operations

- isFull ()
- isEmpty ()

I. Write C++ code for the array based (static) implementations of the above operations.

(04 Marks)

II. Write C++ code for the linked list based (dynamic) implementation of the above operations.

(04 Marks)

f) What do you understand by the term "Stack Overflow"?

(02 Marks)

g) Give two examples for applications of stacks.

(02 Marks)

Question 03

a) What is Queue Data Structure?

(02 Marks)

b) Give two examples for applications of queues.

(02 Marks)

c) Graphically illustrate the following scenario using a Queue. Assume that the queue has already initialized and it is empty at the beginning.

Scenario:

Consider the following sequence.

M A @ + - @

In the above sequence;

- Each alphabetic letter inserts the letter into the queue.
- Each operator (+, -, etc.) deletes an item from the queue.
- Each @ symbol represents y=isEmpty()

(06 Marks)

- d) Graphically illustrate the static (array based) implementation of the following Queue operations sequentially. Note: Size of the array is 5.

(05 Marks)

- I. initializeQueue()
- II. enqueue (M)
- III. enqueue (S)
- IV. q = isFull()
- V. x = dequeue ()

- e) Write down the C++ implementation of a Node which can be used in Dynamic (Linked list) implementation of a Queue.

(04 Marks)

- f) Give static (Array based) implementation of the following queue operations.

- I. Insert operation
- II. Deletion operation

(06 Marks)

Question 04

- a) Explain "Tree Data Structure" with a suitable graphical example.

(03 Marks)

- b) Explain how binary search trees are different from binary trees. Use suitable graphical examples.

(06 Marks)

- c) Briefly explain the following terms related to the tree data structures.

- I. Root
- II. Leaf
- III. Size of a tree
- IV. Depth of a node
- V. Degree of a node
- VI. Degree of a tree

(06 Marks)

- d) Briefly explain the following types of binary trees.

- I. Full binary tree
- II. Complete binary tree
- III. Perfect binary tree

(03 Marks)

- e) State one advantage and one disadvantage of binary trees.

(02 Marks)

- f) Insert following data set into a binary search tree.

Data Set: 21, 40, 15, 30, 16, 11, 19, 1, 50, 45

(05 Marks)

Question 05

- a) What is sorting?

(01 Mark)

- b) Consider the following data set.

Data Set: 65, 20, 40, 6, 15

I. Sort the above data set using selection sort.

II. Sort the above data set using bubble sort.

Note: Show your step by step work clearly.

(2 x 4 Marks)

c) Write a C++ code to implement swap function which can be used in selection sort algorithm.

(03 Marks)

d) What do you understand by the term Searching Algorithm?

(01 Mark)

e) Briefly explain following searching algorithms.

I. Sequential Search

II. Binary Search

(04 Marks)

f) Write down the pseudo codes for following algorithms.

I. Linear search

II. Binary search

(2 x 04 Marks)