



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, 2nd Semester Examination - 2012

IT 2003 Data Structures & Algorithms (New)

Instructions for Candidates:

Answer any 5 (five) questions.

All questions carry equal marks.

No of pages : 04

No of questions : 08

Time : Three (03) hours

(1)

- (i) What are linear and non-linear data structures? Give two examples for each. (04 marks)
- (ii) What is an abstract data type? List two user defined abstract data types. (04 marks)
- (iii) Explain arrays and pointers used in data structures. (04 marks)
- (iv) What is a multi-dimensional array? (03 marks)
- (v) Write a program to create the following two dimensional array and display its elements on the screen.

| | | |
|---|---|---|
| 2 | 4 | 7 |
| 1 | 3 | 6 |

(05 marks)

(Total Marks 20)

(2)

- (i) What is the importance of "data structures"? (02 marks)
- (ii) What is a Stack? Give one application area of Stack. (04 marks)
- (iii) Consider the sequential representation of a Stack data structure
The associated declaration contain

```
int stack [20];  
int top;
```

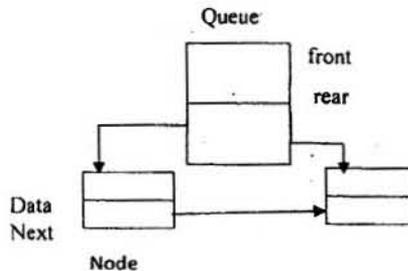
 - a) Write a function to perform the push operation. (05 marks)
 - b) Write a function to perform the pop operation. (05 marks)
- (iv) Define stack overflow and stack underflow. (04 marks)

(Total Marks 20)

(3)

- (i) "Queue is a First In First Out (FIFO) Data Structure." Describe. (03 marks)
- (ii) Write classes to declare the link representation of the queue according to the following representation.

front, rear and next are the pointers. Data is the integer type data.



(05 marks)

- (iii) Using the declaration in part (ii)

(a) Write an Insert function to insert the user given number to the Queue.

(06 marks)

(b) Write a Delete function to remove the input sequence and display them.

(06 marks)

(Total Marks 20)

(4)

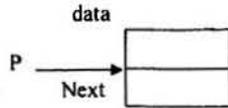
- (i) What is the main drawback of the linear queue? Explain it using an example. (05 marks)
- (ii) Explain how to avoid the above limitation. (03 marks)
- (iii) List advantages of Dequeue over Queue. (04 marks)
- (iv) Considering the link representation of the Dequeue, Explain the following using diagrams
- (a) How to insert an element to the front of the Deque (04 marks)
- (b) How to delete an element from the back of the Deque. (04 marks)

(Total 20 marks)

(5)

(i) Define Linked List. (04 marks)

(ii) Using the following representations, write a class to declare the link representation of the Singly Linked List.



“data” is the character type data and “next” is the pointer. “P” is the pointer used to point to the whole linked list. (05 mark)

(iii) Using the part (ii), write functions to accomplish the following:

(a) Add an element to the front of the list (05 marks)

(b) Add an element to the linked list after the given element in the list. (06 marks)

(Total 20 marks)

(6)

(i) Define following terms

(a) Degree of a node (02 marks)

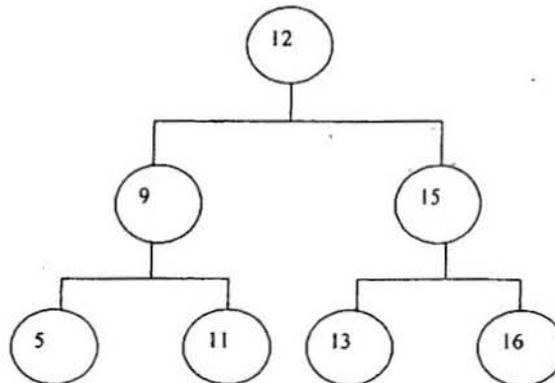
(b) Degree of a tree (02 marks)

(c) Height of a tree (02 marks)

(d) Forest (02 marks)

(ii) Compare and contrast binary trees and binary search trees. (06 marks)

(iii) Describe the pre-order, in-order and post-order traversal using the following Binary Search Tree.



(2x3 marks)
(Total 20 marks)

(7)

- (i) What is an algorithm? (04 marks)
- (ii) What do you mean by Internal sorting and External sorting? (06 marks)
- (iii) What is the main operation associated with the Exchange (Bubble) sort algorithm? (04 marks)
- (iv) Write a function to implement the Exchange (Bubble) sort algorithm. The function should take in an array of n element and return the sorted array. (06 marks)

(Total 20 marks)

(8)

- (i) What are the two main searching techniques? Describe them. (08 marks)
- (ii) What is meant by recursion technique? (03 marks)
- (iii) Define Big O notation. (03 marks)
- (iv) For selection sort, find the Big O notation expressions for the number of comparisons and number of exchanges in sorting an array of n elements in the following cases.
 - (a) For Outer loop (03 marks)
 - (b) For Inner loop (03 marks)

(Total 20 marks)