Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (FT)/SEM-4/CS-415/2010

2010

DATA STRUCTURE ALGORITHMS

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Consider the following two functions

$f(n) = n^3$, if $0 \le n < 10{,}000$

$= n^2$ otherwise

And

$g(n) = n$, if $0 \le n < 100$

$= n^2 + 5n$ otherwise

Which of the following is true ?

a) $f(n)$ is $O(n^3)$

b) $g(n)$ is $O(n^3)$

c) $O(f(n))$ is same as $O(g(n))$

d) $g(n)$ is $O(n^2)$.

ii) The expression which accesses the $(ij)^{th}$ entry of a $m * n$ matrix stored in column major form is

a) $n * (i - 1) + j$ b) $m * (j - 1) + i$

c) $m * (n - j) + j$ d) $n * (m - i) + j$.

iii) The minimum number of fields with each node of doubly link list is

a) 1 b) 2

c) 3 d) 4.

iv) The prefix expression for the infix expression

$A + B* (C + D) / F + D*E$

is

a) $AB + CD + *F/D + *$

b) $ABCD + *F/+ DE* +$

c) $A * B + CD/F* DE ++$

d) none of these.

v) Stack is useful for implementing

a) Radix sort

b) Breath first search

c) Recursion

d) Depth first search.

vi) Which of the following data structures may give a overflow error, even though the current number of element in it less than its size ?

a) Simple queue b) Circular queue

c) Stack d) none of these.

vii) Which of the following statements is false ?

a) Every tree is a bipartite graph

b) A tree contains a cycle

c) A tree with n nodes contains ($n - 1$) edges

d) A tree is a connected graph.

viii) Identify the correct statements about the AVL tee.

i) In the tree height of two sub-trees of every node never differ by not more than one

ii) Balance factor of each node is – 1, 0, 1

iii) The maximum height of a blance binary search tree is $1.44 \log_2 4$.

a) (i) & (ii) b) (ii) & (iii)

c) (i) & (iii) d) All of these.

ix) Number of vertices of odd degree graph is

a) always even b) always odd

c) either even or odd d) always zero.

x) Consider that n elements are to be sorted. The worst case complexity of Bubble sort is

a) $O(1)$ b) $O(\log_2 n)$

c) $O(n)$ d) $O(n^2)$.

xi) Merge sort uses

a) divide and conquer strategy

b) backtracking approach

c) heuristic search

d) greedy approach.

xii) The best sorting method if the number of swapping done is the only measure of efficiency is

a) bubble sort b) selection sort

c) insertion sort d) heap sort.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) Explain $f(n) = O(g(n))$.

   b) What are the disadvantage and advantage of Binary search over liner search ? 2 + 3

3. a) What is stack ?

   b) Write the algorithm of POP and PUSH of stack. 1 + 4

4. Write a *C* function to reverse a linked list physically.

5. Construct a Binary Search Tree with the help of following in order and post order traversal :

   post order : G,E,C,A,B,D,F,L,J,I,K,M

   in order : A,B,C,D,E,F,G,I,J,K,L,M

6. a) What is hashing ? Why is it used ?

   b) Explain the chaining method of collision resolution in hashing. 2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What is linear data structure ?

   b) Do you consider the following data structure as linear ?

      i) Circular doubly linked list

      ii) Binary tree

      Explain for both cases.

   c) Represent the following polynomial by linked list (show the diagram only) :

      $9x \wedge 5 + 3x \wedge 3 - 8x + 15$

   d) Write an algorithm to delete all nodes having value greater than *X* from a given singly linked list.

   1 + 6 + 2 + 6

8. a) Define circular queqe.

   b) Write an algorithm to insert an item in circular queue.

   c) What is input restricted dequeue ?

   d) Write an algorithm to convert an infix expression to postfix using stack. 2 + 5 + 2 + 6

9. Define AVL tree and threaded binary tree.

   Insert the following keys in that sequence into an AVL three, clearly indicating the various rotations used.

   6, 3, 1, 2, 4, 5, 7, 8, 10, 12 3 + 2 + 10

10. a) What is a graph ? Find out the shortest path between all pairs of nodes in the given graph by Kruskal's algorithm.

Dia.

b) Analyze selection sort algorithm with example.

(1 + 7) + (4 + 3)

11. a) What do you mean by external sorting ? How does it differ from internal sorting ?

b) Write down the DFS algorithm.

c) How is random access file different from indexed sequential file ? What is Garbage collection ? 3 + 6 + 6