



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

$$\begin{aligned} f(n) &= n^3, & \text{if } 0 \leq n < 10,000 \\ &= n^2 & \text{otherwise} \end{aligned}$$

And

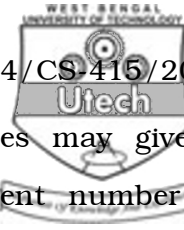
$$\begin{aligned} g(n) &= n, & \text{if } 0 \leq n < 100 \\ &= n^2 + 5n & \text{otherwise} \end{aligned}$$

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 $(ij)^{\text{th}}$ 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 tree.

- 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 balance binary search tree is $1.44 \log_2 n$.
- 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) :

$$9x^5 + 3x^3 - 8x + 15$$

- 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 queue.
- 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.

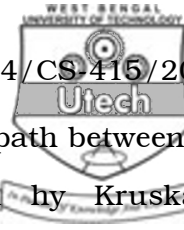
$$2 + 5 + 2 + 6$$

9. Define AVL tree and threaded binary tree.

Insert the following keys in that sequence into an AVL tree, 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 ? $3 + 6 + 6$

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