2011

MCA

Paper : 3.2

(Data Structure and Algorithm)

Full Marks : 70

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer : 1×7=7

(a) The best case run-time complexity of selection sort algorithm is

(i) $O(n)$

(ii) $O(n^2)$

(iii) $O(n \lg n)$

(iv) None of the above

(b) $f(n) = \Theta(g(n))$ if and only if

(i) $g(n) = \Omega(g(n))$

(ii) $g(n) = \Theta(f(n))$

(iii) Both *(i)* and *(ii)*

(iv) None of the above

(c) Array is

(i) abstract data type

(ii) composite data type

(iii) primitive data type

(iv) None of the above

(d) Which one of the following is not an application of stack?

(i) Reversing string

(ii) Conversion of infix notation to postfix notation

(iii) Conversion of infix notation to prefix notation

(iv) Conversion of postfix notation to infix notation

(e) A complete binary tree of depth n have at most

(i) n nodes

(ii) 2^n nodes

(iii) 2^{n+1} nodes

(iv) $2^{n+1} - 1$ nodes

(f) AVL tree is

(i) weight balanced tree

(ii) height balanced tree

(iii) threaded binary tree

(iv) All of the above

(g) Topological sorting is

(i) linear ordering of vertices

(ii) linear ordering of edges

(iii) Both (i) and (ii)

(iv) None of the above

2. Fill in the blanks : 1×7=7

(a) Adjacency list is the —— representation of graphs.

(b) For a queue, implemented using array, the initial value for front and rear is ——.

(c) In case of heap sort, —— heap is used to sort the data in ascending order.

(d) In a circular linked list, if the address field of the last node points itself, then the number of maximum node in the list is ——.

(e) All nodes are of either zero or two degree(s) in case of —— tree.

(f) Linear probing is a technique to resolve ——.

(g) Heap is a —— data structure.

3. Match the Column—A with Column—B : 1×7=7

Column—A	*Column—B*
(a) Circular queue	*(i)* Inorder traversal gives the key values in ascending order
(b) Binary search tree	*(ii)* Binary search
(c) Hashing	*(iii)* Can be traverse in both directions
(d) Depth-first search	*(iv)* Linear search
(e) Brute-force algorithm	*(v)* Array implementation
(f) Doubly linked list	*(vi)* Kruskal's algorithm
(g) $O(\lg n)$	*(vii)* Quick sort
	(viii) $\Theta(V + E)$
	(ix) Division remainder method

4. State whether True or False : 1×6=6

(a) Priority queue can be implemented using heap.

(b) The worst case run-time complexity of merge sort is $O(n \lg n)$.

(c) Queue is also called first-in, last-out data structure.

(d) Circular linked list has one NULL pointer.

(e) A *B* tree is a type of binary tree.

(f) Prim's algorithm for minimum spanning tree is a greedy algorithm.

5. *(a)* What is array? The base address of the integer array A [30] [40] is 401. Find out the address of A [23] [15]. 5

(b) Define small 'o' asymptotic notation. Show that

$$\frac{1}{3}n^2 - 2n = \Theta(n^2)$$ 1+4=5

6. Give answers to any *three* of the following questions : 5×3=15

(a) Define stack. Implement stack using array.

(b) Write down an algorithm to delete the first and last nodes from a doubly linked list.

(c) Write down a C function to insert a new node into a binary search tree.

(d) Explain breadth-first search traversal technique.

(e) What is recurrence? Find out the asymptotic tight bound for the following recurrence :

$$T(n) = 2T\left(\frac{n}{2}\right) + \Theta(n)$$

7. Give answers to any *three* of the following questions : 6×3=18

(a) Find out the worst and best case analyses for insertion sort algorithm.

(b) Write a program to implement merge sort algorithm.

(c) What is graph? Explain the representations of graph.

(d) Define hashing. Explain two collision resolution techniques.

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