2010

MSc—IT

Paper : 2.2

(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 option : 1×7=7

(a) First-in Last-out is

(i) queue

(ii) circular queue

(iii) B-tree

(iv) None of the above

(b) Data structure used in conversion of expression from infix notation to postfix notation is/are

(i) queue

(ii) stack

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

(iv) None of the above

(c) The worst case run-time complexity of hashing is

(i) O(1)

(ii) O(lg n)

(iii) O(n)

(iv) None of the above

(d) Which is not a collision resolution technique of hashing?

(i) Division-Reminder method

(ii) Open addressing

(iii) Separate chaining

(iv) Both (i) and (iii)

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

(i) n nodes

(ii) 2^n nodes

(iii) 2^{n+1} nodes

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

(f) Which is a Greedy algorithm?

(i) Kruskal algorithm for minimum spanning tree

(ii) Dijkstra's algorithm for single source shortest path

(iii) Prim's algorithm for minimum spanning tree

(iv) All of the above

(g) Which is not an example of abstract data type?

(i) Stack

(ii) Queue

(iii) Array

(iv) None of the above

2. Fill in the blanks : 1×7=7

(a) The mathematical formula that maps the key to some slot in the hash table is called ——.

(b) —— sort algorithm is linear time complexity algorithm.

(c) —— is the array representation of graph.

(d) In a —— traversal, the root node is visited after traversing its left and right subtrees.

(e) For a graph having 6 nodes, each spanning tree must have —— edges.

(f) For a queue, implemented as array, the initial value of front and rear is set to ——.

(g) In C, the —— function is used to allocate memory to a node in a linked list.

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

Column A	*Column B*
(a) Double hashing	*(i)* Complete binary tree
(b) Binary search	*(ii)* Ordering of the vertices of a graph
(c) Priority queue	*(iii)* Heap sort
(d) Heap	*(iv)* Warshall's algorithm
(e) Topological sort	*(v)* Linear search
(f) $O(n \lg n)$	*(vi)* Hash table
(g) Brute force algorithm	*(vii)* Job scheduling by operating system
	(viii) $O(\lg n)$
	(ix) Collision in hashing

4. State whether True or False : 1×7=7

(a) The direction of a single-linked list cannot be reversed.

(b) Every tree is a graph.

(c) Binary search is the fastest searching algorithm.

(d) $f(n) = O(g(n))$ if and only if $g(n) = \Omega(f(n))$.

(e) Insertion sort is a stable algorithm.

(f) Circular queue is implemented with circular-linked list.

(g) B-tree is a weight balanced tree.

5. (a) What are the advantages and disadvantages of linked-list over array? 4

(b) Define the asymptotic notations big O and θ. For any two functions $f(n)$ and $g(n)$, prove that $f(n) = \theta(g(n))$ if and only if $f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$. 2+3=5

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

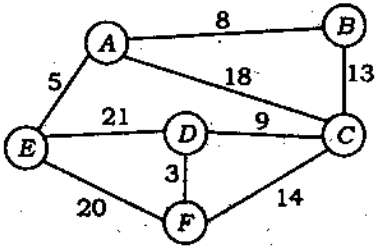
(a) Find out the worst and best case analysis for Selection sort algorithm.

(b) Write down the algorithm for Preorder traversal of binary tree. Define AVL tree with an example.

(c) Define binary search tree and explain its linked-list representation.

(d) Write down a C function to insert a new node into a double-linked list at some position passed to the function as an argument.

(e) What is minimum spanning tree? Find out the minimum spanning tree from the following graph using prim's algorithm :



7. Answer any *three* of the following questions : 6×3=18

(a) Define queue. Implement queue using circular-linked list.

(b) Write down the Quick sort algorithm. What is the worst and best case time complexity of Quick sort algorithm?

(c) $T(n) = 3T(n/4) + cn$

Find out the asymptotic tight bounds for the above recurrences using recursion-tree method.

(d) Define threaded binary tree.

Inorder : H D I B J E K A L F M C N G O
Preorder : A B D H I E J K C F L M G N O
Postorder : H I D J K E B L M F N O G C A

Draw the binary tree using the given Inorder, Preorder and Postorder traversal.

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