

Paper - 10
29/1/18

INDIAN STATISTICAL INSTITUTE
MS-LIS 1st Year, 2017-2018 (Semester - II)
Data Structures and Computer Programming
End Semester Examination

Full Marks : 50

Time Allotted: 3hrs

SECTION - A

Write the following statements TRUE or FALSE

7x1=7

- A1. Complexity of algorithm to interchange the n^{th} and m^{th} node of a singly linked list is $O(m)$ if $m \leq n$, otherwise $O(n)$.
- A2. Two linked lists having 'm' and 'n' number of elements are both in ascending order. The worst case time complexity of a program to print common elements of two lists is $O(m+n)$.
- A3. Let, with two singly linked lists L1 and L2 having 'n' and 'm' number of elements respectively, we need to create a singly linked list L having all the elements of L1 and L2. The complexity of the algorithm is $O(n+m)$.
- A4. The best case time complexity of finding an element in binary search tree having 'n' number of nodes is $O(\log_2 n)$.
- A5. The time required to search the record pointer of key 'k' in a B+ tree of order 'm', having height 'h' and 'n' total number of keys is $O(h)$.
- A6. The maximum element in a min-heap represented by an array can be computed in $O(1)$ time.
- A7. The worst case time complexity of searching an element in hash table of size 'm' with linear probing is $O(\log_2 m)$.

SECTION - B

Pick the appropriate answer from given options

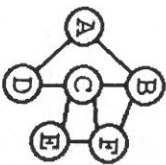
8x2=16

- B1. The elements 1, 2, 3, 4, 5, 6 are to be enqueued in a queue in this order. A dequeue operation can be performed anytime. Which of the following permutation can be obtained as the output of the queue?

- (a) 123456 (b) 243651 (c) 152436

B2. What can be the contents of the stack from bottom to top at a time instant in evaluating the postfix expression: $584/+32^*$ (assume numbers are of 1 digit size)
 (a) 7,6 (b) 7,5 (c) 7,1

B3. Consider the following traversal sequences of the given graph.
 I. ABCDEF II. ABECFD III. ABCEFD IV. ABCDFE
 Which of the above sequences represent(s) Depth First Search traversal?
 (a) II and III (b) I and III (c) I, III and IV



B4. In a circular linked list organization, insertion of a record involves the modification of
 (a) 1 pointer (b) 2 pointers (c) 3 pointers

B5. A complete binary tree is implemented by using an array 'A'. Suppose A[i] contains a node, then which of the following statement(s) is/are correct?
 I. has left child at $A[2*i+1]$ and right child at $A[2*i+2]$
 II. has left child at $A[2*i]$ and right child at $A[2*i+1]$
 III. its parent will be at $A[i/2]$
 (a) I only (b) I and III (c) II and III

B6. Suppose we have numbers between 1 to 100 in a binary search tree and we are searching for 36. Which of the following sequence cannot be the sequence of the nodes examined?
 (a) 2,25,40,28,39,36 (b) 92,22,91,24,89,25,36 (c) 92,20,91,24,95,36
 (a) 1 (b) $n+1$ (c) 2^n

B8. Suppose a hash table of size 10 (index 0 to 9) uses hash function $k \pmod{10}$ and uses linear probing to resolve collision. Suppose there are elements in all odd indices. Minimum how many comparison is needed to search an element that doesn't exist in the hash table?
 (a) 1 (b) 2 (c) 10

SECTION - C
 Short-answer type question. Please be precise. 9x3=27

- C1. Let, stack A has n unsorted numbers, stack B is empty. How can u sort (ascending or descending) the numbers in A using this two stacks? Remember, numbers can be accessed only using stack operations.
- C2. In-order and pre-order traversal of a binary tree having 10 nodes is DBHJEAIFCG and ABDEHJFIG respectively. How many leaf-nodes are there?
- C3. To insert keys 3, 2, 1, 4, 5, 6, 7 in an AVL tree in this order, how many and which type of rotations are required?
- C4. Calculate the minimum number of nodes of an AVL tree of height 7.
- C5. Insert keys 3, 2, 1, 4, 5, 8, 7 in a binary max-heap in given order. How many swaps are required?
- C6. How can you find out the k^{th} smallest element from an unsorted array of 'n' number of elements in $O(k \log n)$ time?
- C7. Let 2, 6, 1, 5, 4, 3, 7, 8 keys in this order are inserted in a B-tree of order 3. What will be the root block and what will be the height of the tree?
- C8. Calculate the maximum number of keys can be stored in a B-tree of order 5 and height 4.
- C9. Suppose in a B-tree a search key field is of 8 bytes, a record pointer is of 6 bytes and a block pointer is of 5 bytes. If the block size is of 512 bytes, what will be the maximum order of that B-tree?