Qn. Set Code-1

AUTUMN END SEMESTER EXAMINATION-2022
3rd Semester B.Tech

DATA STRUCTURES AND ALGORITHMS
CS-2001 / CS 2001

(For 2022 (L.E), 2021 & Previous Admitted Batches)

Time: 3 Hours   Full Marks: 50

Answer any SIX questions.
Question paper consists of four SECTIONS i.e. A, B, C and D.
Section A is compulsory.
Attempt minimum one question each from Sections B, C, D.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable
and all parts of a question should be answered at one place only.

SECTION-A

1.   Answer the following questions.   [1 × 10]

(a)   Write the content of array p[] for *n=6*.
   int func(int n)
      {
          int k = 0, p[20];
          for(int i = n/2 ; i<=n; i++)
              for(int j = 1 ; j < n ; j*=2)
                  p[k++] = i +j;
          return k;
      }

(b)   Assume that 4-byte of storage is required by each element of the array a[-10..10, -10..10] with starting location 1000. Compute the address of a[6, 5] in row major and column major order.

(c)   Create a function that searches for an integer num in a double linked list and displays the content (info/data) of its left node and right node. In case of unavailability, the content should be displayed as -1.

(d)   Evaluate the following postfix expression where a=10, b=2, c=3, d=5, e=4
      a b / c - d e * + a c * -

(e) The seven elements A, B, C, D, E, F, and G are pushed onto a stack in reverse order, i.e., starting from G. The stack is popped five times and each element is inserted into a queue. Two elements are deleted from the queue and pushed back onto the stack. Finally, one element is popped from the stack. Stepwise show the content of both stack and queue.

(f) Consider the following inorder and preorder traversal of one binary tree. Construct the tree and find the postorder sequence of the corresponding binary tree.

Inorder : 11, 22, 25, 33, 35, 55, 66, 77, 99
Preorder : 55, 22, 11, 33, 25, 35, 77, 66, 99

(g) Construct a BST for the given sequence of elements and convert it to the two-way threaded BST tree.

90, 80, 110, 60, 85, 209, 15, 65, 10

(h) Write/draw the linked list representation and array representation of the following graph.
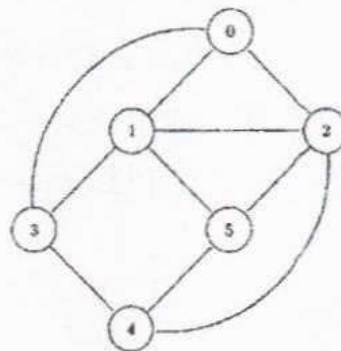
(i) Let QuickSort program P is applied on the 2 sets of inputs to sort the numbers in ascending order using the first element as a pivot. Let t1 and t2 be the number of comparisons made by P for the inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2} respectively. What is the value of t1 and t2, and what is the relation (< or >) among them?

(j) Write a function that concatenates two circular linked lists into one circular linked list.

SECTION-B

2. (a) Write a C-code or pseudo-code to separate all odd numbers and even numbers of a list of *n* elements such that all odd numbers will appear before the even numbers. Choose a suitable data structure for the list. For example, [4]

consider the following input and output of the program.

Input: 11, 22, 33, 44, 66, 55, 77, 88, 99, 10

Output: 11, 33, 55, 77, 99, 22, 44, 66, 88, 10

(b) Write insertion and deletion functions to implement an output restricted double-ended queue. [4]

3. (a) Convert the following infix expression to its corresponding prefix expression using the suitable data structure. [4]

A * B - (C + D) - (E - F) + F / H ^ I

(b) What is the requirement of hashing? [4]
Demonstrate insertion of keys 5, 28, 19, 15, 20, 33, 12, 17, and 10 into a hash table with separate chaining-based collision resolution strategy. Let the table have 9 slots and it uses the division hash function.

SECTION-C

4. (a) Given two single linked lists, write the code to merge their nodes to make one list, taking nodes alternately between the two lists. So the output with {1, 2, 3} and {7, 13, 1} should yield {1, 7, 2, 13, 3, 1}. If either list runs out, all the nodes should be taken from the other list. [4]

(b) Perform the ascending order sorting of the given elements by using the Heap sort algorithm. Illustrate your approach step by step. [4]

20, 30, 35, 45, 57, 11

5. (a) Insert the following sequence of characters in the height-balanced BST (AVL tree). Find the preorder and postorder traversal of the AVL tree. [4]

J, R, D, G, T, E, M, H, P, A, F, Q

(b) Represent the following sparse matrix in the triplet form using the data structure array and linked list. Write the C-code or pseudo-code to add two sparse matrices using any of the representation. [4]

$$\begin{bmatrix} 0 & 0 & 1 & 0 & 2 \\ 4 & 0 & 0 & 0 & 0 \\ 3 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 9 & 6 \end{bmatrix}$$

6. (a) Write the appropriate iterative procedure to traverse a binary search tree that outputs the elements in an arranged (ascending) form. [4]

(b) Perform insertion of the following elements in a 3-way B-tree step by step. [4]
100, 95, 55, 101, 44, 75, 88, 34, 40, 20, 25, 150, 180, 99, 70

SECTION-D

7. (a) Write an appropriate traversal algorithm so that the algorithm visits the vertices in a depth-wise order starting from a given node. Illustrate the step by step traversal considering starting vertex as vertex 'A'. [4]
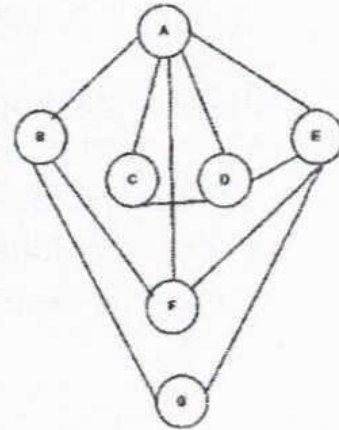
(b) Sort the following lists in ascending order using insertion sort. Show the step by step process. [4]

S, T, R, U, C, T, U, R, E, S, D, A, T, A

8. (a) Write a program to insert n records (nodes) of student profiles in a double linked list such that the records or nodes will be present in ascending order of the student's CGPA. [4]
The student profile consists of roll number(int), name (string), and CGPA (float).

(b) Write a c-code or pseudo code that will create a new linked list by removing alternative nodes from the given linear linked list. Display the resultant two linked lists (old and new). [4]
Input: 2->5->3->7->8
Output: Old List: 5->7
        New List: 2->3->8

Input: 2->5->3->7
Output: Old List: 5->7
        New List: 2->3

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