15384

M. Tech 1st Semester Examination

Data Structure & Algorithm Analysis in C (NS)

CSE1-514/MT-104

Time : 3 Hours   Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Each question carries 20 marks. Attempt one question from each section. Section E is compulsory.

SECTION - A

1. (a) Explain how the following "infix" expression is evaluated with the help of Stack:

    5* (6+ 2) − 12/4.

   (b) Explain the algorithm to delete a node with a given item of information in a singly linked list.

   (c) Write an algorithm to insert an ITEM into a sorted doubly linked list between nodes A and B, where location of A and B is not known.   (7+7+6=20)

2. (a) Assume that each element of an array 'A' stored in row-major order occupies four bytes of memory. If 'A' is declared as: int a [10][20][5], And the address of the first element of 'A' is 2000, find the address of the array element A[5][12][4].

   (b) Write an algorithm to delete duplicate numbers from a linear array.   (10+10=20)

[P.T.O.]

SECTION - B

3. (a) Write an algorithm to give inorder traversal of binary tree.

   (b) Explain Hashing. Define some hash functions like folding method. What is collision and how they are resolved?
                       (10+10=20)

4. (a) What is the need for using circular array to implement queues?

   (b) (i) Draw the binary tree T with node labels a, b, c, d, e, f and g for which the inorder and postorder traversals result in the following sequences.

    Inorder   a f b c d g e
    Postorder   a f c g e d b

   (ii) Find the one way preorder threading of T drawn in (i).   (10+10=20)

SECTION - C

5. (a) Write an algorithm to insert an element into a heap. What is best and worst case complexity for your algorithm?

   (b) Write an algorithm A that finds the k-th largest of n elements using a sequence of element comparisons. Prove that A collects enough information to determine which elements are larger than the k-th largest and which elements are smaller (without having to do more comparisons).   (10+10=20)

6. (a) A sorting method is said to be stable if at the end of the method, identical elements occur in the same order as in the original unsorted set. Is merge sort a stable sorting method? Support your answer properly.

   (b) How you can implement priority queues with the help of heap?   (10+10=20)

SECTION - D

7. (a) A vertex v is called sink of G if there is a path from every vertex in G to v. Write an efficient algorithm to check if DAG has a sink. (also give an example) (Hint: A DAG may have at most one sink).

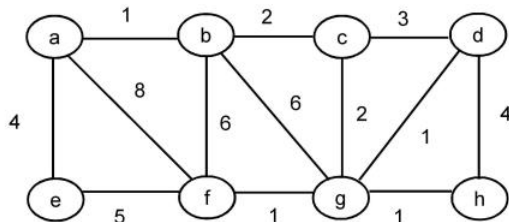   (b) Write Kruskal's algorithm to find a minimum spanning tree of graph given in Fig. 1.

Fig. 1   (10+10=20)

8. Recall that in Huffman coding problem, we are given a set of n characters along with their frequencies. We are required to represent each character by unique codeword using O's and I's, such that no codeword is prefix of another. The goal is to find out such codeword to achieve maximum compression.

   (a) Construct the optimal code for six characters a, b, c, d, e, f with frequencies 14, 3, 6, 10, 12, 8 respectively. How many bits are needed to encode a string containing 14a's, 3b's, 6c's, 10d's, 12e's, and 8f's using this code? How many bits would be needed if we use three bits for each character? Which is better?

   (b) Encode the string: beacffead using your code.

   (c) Let x & y be two characters having lowest frequencies. Is it true that both are siblings in every prefix tree (tree made to find code)? Justify your answer in two lines.

   (20)

[P.T.O.]

SECTION - E

9. Write short notes on:

   (i) When will you say an algorithm efficient? Give the notations for time complexity.

   (ii) Write the role of stack in function call.

   (iii) What is hashing function?

   (iv) What is the difference between binary tree and binary search tree?

   (v) Which is the best way of choosing the pivot element in quick sort?

   (vi) Merge sort is better than insertion sort. Why?

   (vii) Define a graph. How it differs from tree?

   (viii) What is minimum spanning tree? Name any two algorithms used to find MST.

   (ix) Explain Depth - First search.

   (x) What is Sorting and Merging?   (10×2=20)