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B. Tech. III - Sem. (Main) Exam., May – 2023

Computer Science and Engineering

3CS4 -03 Data Structures and Algorithms

Common to CS, IT, AI, DS, MC, CM, CD, CA, AD, AM, CY, IO

Time: 3 Hours **Maximum Marks: 120**

Min. Passing Marks:

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 10 × 2 marks = 20 marks. All ten questions are compulsory.*

Part – B: *Analytical/Problem solving questions 5 × 8 marks = 40 marks. Candidates have to answer five questions out of seven.*

Part – C: *Descriptive/Analytical/Problem Solving questions 4 × 10 marks = 60 marks. Candidates have to answer four questions out of five. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

Q.1 Is the array with values <23, 17, 14, 6, 13, 10, 1, 5, 7, 12> a max-heap?

Q.2 Find the running time of the following code (using Big-O notation) -

```
for (i = n; i> = 1; i = i-n/2)
        printf ("BTU");
```

Q.3 The following numbers are inserted into an empty binary search tree in the given order -

10, 1, 3, 5, 15, 12, 16

What is the height of the binary search tree (Hint: height is the maximum distance of a leaf node from the root)?

Q.4 Differentiate between stable and unstable sorting.

Q.5 Explain linear probing in the context of Hashing.

Q.6 Discuss any one way of representing a directed graph.

Q.7 Calculate the best case running time for insertion sort.

Q.8 Differentiate between circular and double-ended queues.

Q.9 Write a procedure for implementing a binary search.

Q.10 What do you mean by Hashing?

PART – B

Q.1 Find the result of evaluating the following postfix expression -

12, 7, 3, –, /, 2, 1, 5, +, *, +

Q.2 Find the solution of the recurrence $T(n) = \sqrt{2}\,T\left(\frac{n}{2}\right) + \log n$.

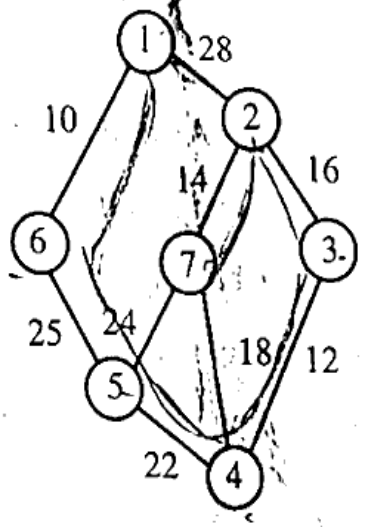
Q.3 Consider the following pseudo-code for a recursive procedure -

```
f(n) {
    if (n<1)
        return;
    print(n); // will print the value of n
    f (n–1);
    print(n)
}
```

Calculate the output when f(3) will be called.

Q.4 In the worst case, the merge sort takes 30 seconds to sort 64 elements. Find the maximum number of elements that can be sorted in 6 minutes using the merge sort.

Q.5, Compute a minimum cost-spanning tree for the following graph using Kruskal's algorithm.



Q.6 Explain Dijkstra's Algorithm for single source shortest path.

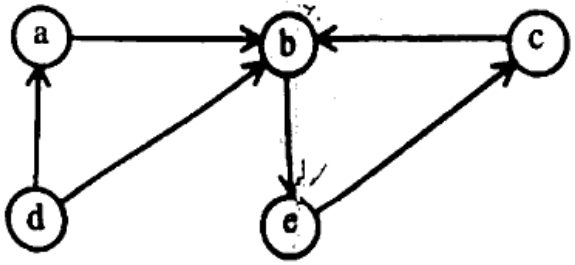
Q.7 Write an algorithm (or pseudo code) to insert an element into an AVL tree.

PART – C

Q.1 Suppose that the 2-D array MARKS [25] [4] is used for representing marks in a class of 25 students and each student has given 4 tests. Again, assume that the base address of the array MARKS is 200. Then the address of MARKS [12][3] will be –

Hint: Assume that Marks are integers taking 4 bytes in the memory (byte-addressable). Further, assume that C language stores 2-D arrays using row-major order.

Q.2 For the graph given below, execute a DFS by showing all the intermediate steps involved (assume that the DFS processes the vertices in alphabetical order, whenever there is a choice).



Q.3 Write an algorithm for quick sorting. Also, calculate and analyze the average case running time of quick sort mathematically.

Q.4 Explain how a priority queue can be implemented using an array. Write a procedure to extract the maximum element from a priority queue.

Q.5 Provide a detailed explanation of how polynomial addition can be performed using linked lists.
