BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH/PRE-PHD **SEMESTER : I/NA**
BRANCH: CS/IT/IS **SESSION : MO/19**

SUBJECT: CS502 ADVANCED DATA STRUCTURES

TIME:3:00 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

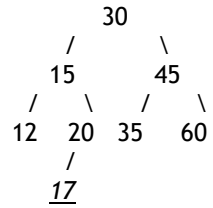
Q.1(a) Differentiate between Hashing and Dictionary. Discuss Hashing application in Message Digest and Compiler Design. [5]

Q.1(b) (i)The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table? [5]
(ii) Consider a hash table with 100 slots. Collisions are resolved using chaining. Assuming simple uniform hashing, what is the probability that the first 3 slots are unfilled after the first 3 insertions?

Q.2(a) What is a skip list? What is the time complexity improvement of skip lists from linked lists in insertion and deletion? To which data structure are skip lists similar to in terms of time complexities in worst and best cases? How to maintain multi-level skip list properties when insertions and deletions are done? [5]

Q.2(b) Construct the following algorithm for Skip List. [5]
(i) Insertion (ii) Searching

Q.3(a) Explain why can't a Red-Black tree have a black node with exactly one black child and no red child? Show and explain the result of deleting 12 from the Red-Black tree (a node in bold is black and an italicized, underlined node is red) depicted below: [5]



Q.3(b) (i) Differentiate binary search tree with B-tree. [5]
(ii) Show the results of inserting the keys
F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E
In order into an empty B-tree with minimum degree 2. Only draw the configurations of the tree just before some node must split, and also draw the final configuration.

Q.4(a) (i) Discuss the relationship between inserting into a binomial heap and incrementing a binary number and the relationship between uniting two binomial heaps and adding two binary numbers [5]
(ii) Construct an algorithm for Binomial-Heap-Merge and its time complexity.

Q.4(b) Construct an algorithm for Fibonacci Heap extracting the minimum node and show its amortized cost of an n-node is O(D(n)) where D represents degree. [5]

Q.5(a) Differentiate the Finite Automata with Boyer Moore algorithm in string matching. Construct string matching algorithm for Boyer Moore. [5]

Q.5(b) Shows different steps using KMP algorithm for string matching by considering a pattern P=abcaby against a Text T=abxabcabcaby. Construct KMP algorithm and analyze its time complexity. [5]

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