Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (SOFTWARE ENGINEERING) END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS[ICT 5121]

REVISED CREDIT SYSTEM
(16/11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Merge the two binomial heaps shown in Fig. Q.1A. Show that N inserts into an initially empty binomial queue take O(N) time in the worst case. 5

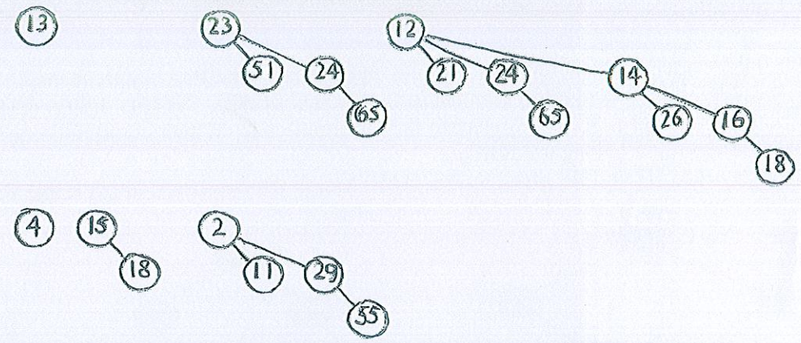

Fig. Q.1A

1B. Write the recurrence relation for the average case analysis of Quick Sort algorithm and solve it. 3

1C. Justify how the randomized skip lists improve the efficiency of insert operation. 2

2A. Discuss the construction of an optimal binary search tree using Dynamic programming technique. Show the optimal binary search tree for the following words, where the frequency of occurrence is in parantheses: *a*(0.18), *and*(0.19), *I*(0.23), *it*(0.21), *or*(0.19). 5

2B. Discuss the method of fast multiplication of 2 n-bit numbers using Divide and Conquer strategy. Analyse the time complexity of the algorithm. Also justify that the algorithm is faster than the normal method. 3

2C. Suppose instead of quadratic probing, we use "cubic probing"; here the i^{th} probe is at $hash(x) + i^3$. Does cubic probing improve on quadratic probing? 2

3A. Find the maximum flow in the network shown in Fig. Q.3A

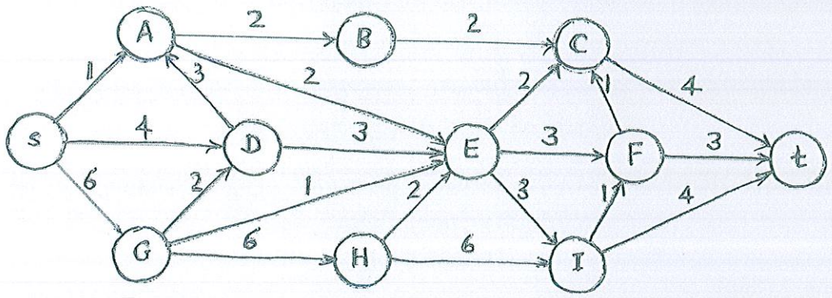

Fig. Q.3A

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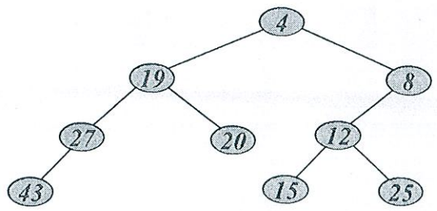
3B. Show the result of inserting the keys 10111101, 00000010, 10011011, 10111110, 01111111, 01010001, 10010110, 00001011, 11001111, 10011110, 11011011, 00101011, 01100001, 11110000, 01101111 into an initially empty extendible hashing data structure with M=4. 3

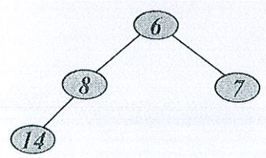
3C. Draw the forest of trees that results from the following sequence of operations using Union by size. Break ties by keeping the first argument as the root.
Union(0,2), Union(3,4), Union(9,7(, Union(9,3), Union(6,8), Union(6,0), Union(12,6), Union(1,11), Union(9,6). 2

4A. A file contains only colons, spaces, newlines, commas and digits in the following frequency: Colon(100), space(605), newline(100), comma(705), 0(431), 1(242), 2(176), 3(59), 4(185), 5(250), 6(174), 7(199), 8(205), 9(217). Construct the Huffman code. Which algorithmic design technique does this algorithm belong to? Justify. 5

4B. Consider two skew heaps H1 and H2 given in Fig. Q.4B. Merge the two heaps into a single skew heap. Show all the steps clearly.



H1



H2

Fig. Q.4B

3

4C. Insert the values 1,2,5,4,6,3,7,8,9 in that order into a B tree with L=2 and M=3. 2

5A. Show the result of accessing the keys 3, 9, 1, 5 in order in the splay tree shown in Fig. Q.5A

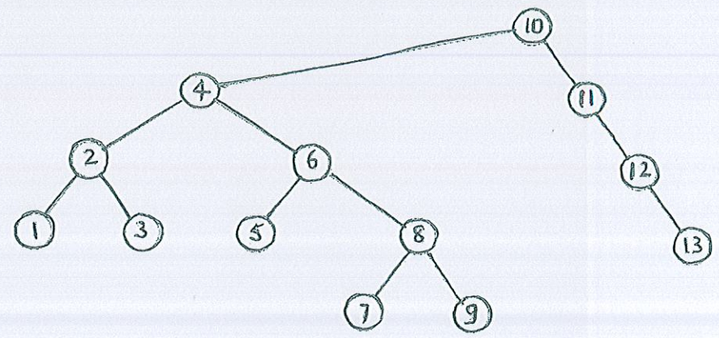


Fig. Q.5A

5

5B. Show the result of deleting the element with key 6 in the resulting splay tree of Q.5A. 3

5C. Describe the Hypercube SIMD models and Shuffle-exchange SIMD models. 2