

This question paper contains 4+2 printed pages]

Your Roll No. 60912

6358

B.Sc. (Hons.) / III Sem. / II Yr. / NS H
COMPUTER SCIENCE

Paper 301 – ALGORITHMS

(New Course)

(Admissions of 2001 and onwards)

Time : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

All questions are compulsory.

Write the answers of all the

parts of a question together.

1. (a) During the running of the procedure RANDOMIZED-QUICKSORT, how many calls are made to the random-number generator function in the worst case ? Discuss the best case also. 3
- (b) Show that there are at most $\lceil n/2^{h+1} \rceil$ nodes of height h in any n -element heap. 3
2. (a) In a hypothetical situation, suppose that you have coins of denomination (in Rupees) 1, 5 and 8.

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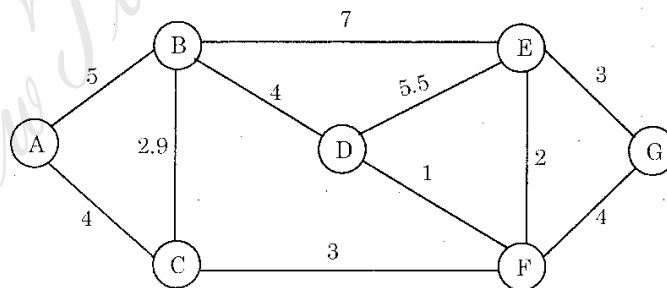
The problem is that you have to collect an amount of Rs. 10 using minimum number of coins.

(i) Give a greedy algorithm for solving this problem. 3

(ii) Discuss the optimality of the your greedy solution for this problem. 2

(b) A sequence of n operations is performed on a data structure. The i th operation costs i if i is an exact power of 2 and 1 otherwise. Use aggregate analysis to determine the amortized cost per operation. 5

3. (a) Use Prim's algorithm to find the minimum cost spanning tree of the following graph : 5



- (b) Multiply the following two matrices using Strasson's algorithm : 5

$$\begin{bmatrix} 2 & 3 \\ 1 & 5 \end{bmatrix} \begin{bmatrix} 1 & 6 \\ 4 & 2 \end{bmatrix}$$

4. (a) Show that the quicksort's best case running time is $\Omega(n \lg n)$. When does it occur ? 4

- (b) What is the running time of heapsort on an array A of length n that is already sorted in increasing order ? What about decreasing order ? 2

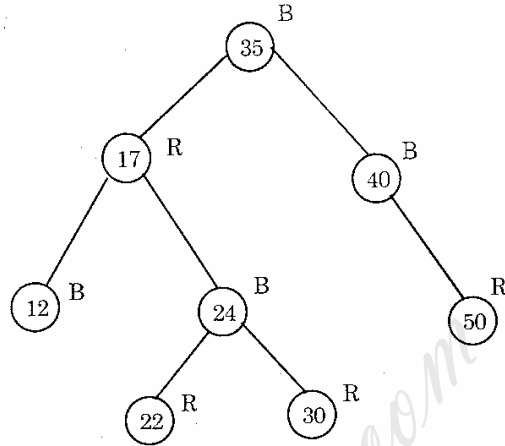
5. (a) Prove that counting sort is stable (you can prove with the help of an example). 5

- (b) Analyze the worst case running time of RANDOMIZED-SELECT algorithm. 4

6. (a) What is the maximum number of times rotation can be performed in a Red-Black tree while inserting a node ? 1

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- (b) Insert the node having value 27 in the following Red-Black tree (color of the nodes are given adjacent to the nodes, R—for red color, B—for black color). 3



- (c) Write the pseudocode for RIGHT-ROTATE in a Red-Black tree. 4

7. (a) Find an optimal parenthesitation of a matrix chain product whose sequence of dimensions is <20, 10, 50, 5, 30>. 5

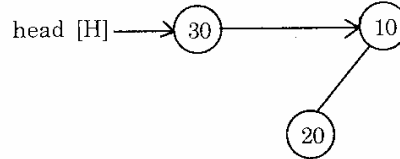
- (b) Give an optimal Huffman code for the following set of frequencies : 4

a : 4 b : 6 c : 7 d : 15 e : 24 f : 35

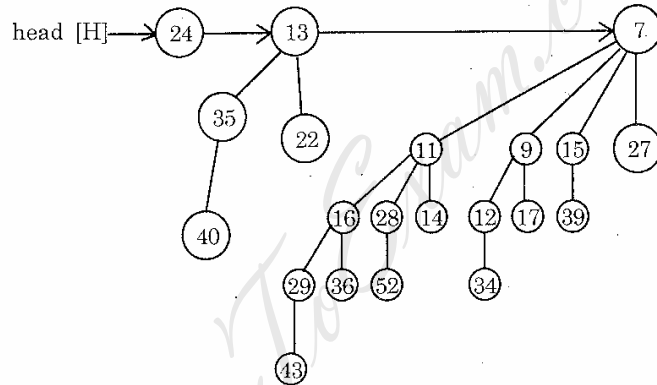
8. (a) Write a non-recursive version of OS-SELECT (x, i) algorithm, which finds an element with the i th smallest key in the subtree rooted at node x . 5

(b) If x is a non-root node in a binomial tree within a binomial heap, how is the degree of a node x compared with its parent? 2

(c) Insert a node having value 15 in the binomial heap given below : 2

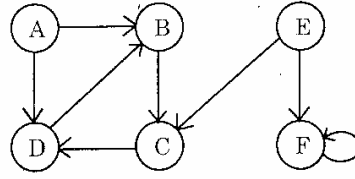


(d) Delete a node having minimum key from the binomial heap given below : 3



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9. Show the stepwise running of Breadth First Search on the following graph using vertex 'E' as the source vertex :



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